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VICTORIA.

DEPARTMENT OF MINES.

RECORDS

OF THE

GEOLOGICAL SURVEY OF VICTORIA

(E. J. DUNN, F.G.S., Director).

Vol. III., Part 2.

GMD

ISSUED BY

W. DICKSON, SECRETARY FOR MINES, UNDER THE AUTHORITY OF THE HON. PETER McBRIDE, M.P., MINISTER OF MINES.

By Authority:
J. KEMP, GOVERNMENT PRINTER, MELBOURNE.

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GEOLOGICAL NOTES ON THE CASTERTON AND COLERAINE DISTRICTS.

By E. J. Dunn, F.G.S., Director, Geological Survey.

Tertiary (Iron-Stone, Etc.).

To the south and west of the Grampians the country in late Tertiary times consisted of a continuous plain, but since that period the Glenelg and Wannon Rivers have carved out extensive valleys, dales, and gullies, leaving remnants of the old plain to form the flat hill tops and plateaux. The general level of this marine plain was from 500 to 600 feet above sea-level.

Southward from the Grampians a sheet of basalt extends almost to the coast. To the south-west and west of the Grampians the Tertiary rocks forming the old plain were composed of sand at the surface, then sand mixed with more or less pisolitic iron ore, and below this were clays of mottled appearance and also mottled red and grey soft sandstones and very calcareous beds in places filled with fossils. Where remnants of the plain survive the surface soil is sandy and of poor quality.

In certain areas the iron ore becomes a prominent feature, and it is largely used for metalling the roads and also for the railway lines. About 2½ miles westward from Merino the iron ore has been excavated over acres of ground, and carried thence for use on the main roads. The sections disclose from 2 to 3 feet of loose pisolitic iron ore (limonite), and below this from 2 to 3 feet of more compact limonite. It looks as though the lower portion had first aggregated and that at one period it was composed of loose pisolitic material, but as further deposition of the iron ore proceeded the interstices were filled in and the loose material bound together into a solid mass. At present only the loose upper portion is removed, and the more solid, which would require to be first broken out and then broken up, is left; ultimately the whole will be removed. This material, as it comes from the gravel pits mixed with sand, would make a perfect concrete with the addition of a little cement, and could be used for building houses, walls, &c., and for culverts on the road. The value of this ore, as a source of iron, has been determined, as there appears to be vast quantities available.

	No. 229.	No. 230.
Iron Fe	28·6%	... 44·6%
P_2O_5	0·14	... 0·28
H_2O	2·13	... 2·8

No. 229.—Pisolitic Iron, Gravel Pits, 2m. S. of Merino.
No. 230.—Limonite. Same locality.

Between Merino and Coleraine the road crosses a Tertiary plateau with pisolitic iron distributed through the sandy material just below the surface. Coleraine is built in the valley, about 300 feet below the plateau.

At Casterton, on the north side of the Glenelg River, and about 2 miles in a north-westerly direction from the town, there is another Tertiary plateau, and here also pisolitic iron ore is excavated for road-making. Its altitude above sea-level is about 640 feet. On the Harrow road, about 4 miles northerly from Casterton and 650 feet above sea-level, there are excavations for road material, and about 2 feet to 2½ feet of pisolitic iron ore is shewn resting on another foot or so of more compact limonite. The size of the pisolitic material ranges from ¼ inch

to 1 inch in diameter with occasional larger pieces. At Roseneath Station, 16 miles north-west from Casterton, there is another piece of the Tertiary plateau 640 feet above sea-level. There is pisolitic iron ore sparsely disseminated near the surface, but no extensive deposits were observed. Mr. F. Chapman, A.L.S., kindly examined a specimen of rock collected about 1 mile north-east from the Roseneath homestead, and found it to be a limestone composed largely of Polyzoa; also ossicles of *? Antedon* sp., fragments of a Gorgonid, numerous Foraminifera and several valves of Ostracoda (*Bairdia* and *Cytherella*). He considers them to be Tertiary beds of Barwonian age. At Maryvale Station the whole country is of Tertiary material, but it is undulating; its height above sea-level is about 500 feet. Soft mottled red and grey sandstone projects through the surface at about 1 mile south of the homestead, and $4\frac{1}{2}$ miles W. 30 deg. N. from the station, in the scrub, there are also outcrops of such soft sandstone. The present watershed appears to run nearly east and west at Goroke, the fall of the ground being northward and southward from this line. At one period all the older rocks of this district, excepting the Grampians, were concealed beneath the Tertiary beds, but the denudation that has since taken place on a vast scale has disclosed a variety of older rocks in the valleys, and has changed what was at one time a dreary plain into most beautiful and picturesque country. Besides the iron ore that occurs in the Tertiary beds, there is also limestone very extensively developed in the region around Mt. Arapiles. It is tufaceous limestone, and burns into an excellent lime which is largely used for building purposes. Lime-burning is carried on principally at Mitre Lake. Basalt of Tertiary age occurs in small outliers, as shewn by Mr. Ferguson, at Roseneath P.R., on Nolan's Creek, $3\frac{1}{2}$ miles further to the north, and at one or two other sites near by; also at Chetwynd where a few square miles are covered by basalt, and between Chetwynd and Harrow is another outcrop.

Jurassic Coal-bearing Beds.

The Jurassic beds do not appear to extend much to the north of a line drawn from Hamilton through Coleraine and on to Roseneath. Southward they are exposed for a mile or more south of Merino, and then they are concealed by Tertiary beds, and their full extent is unknown. Eastward they are covered by basalt, and westerly they narrow in like a wedge at Roseneath. The length of these beds exposed is about 30 miles, and they are 20 miles wide in the broadest part. The exposed part is probably but a fraction of what lies buried below the Tertiary covering, and in all probability these rocks extend to the coast. The valleys and dales that have been scooped out of the extremely soft clayey shales and sandstones are famous for their fertility. The soil ranges from grey to brown and black.

Most of the beds are little firmer than clay, and they are not nearly so indurated as the Jurassic rocks of Gippsland. On the road to Coleraine, and about 6 miles from Merino, there is one quarry in firm sandstone that would be useful for building. It is about 400 feet above sea-level and 200 feet below the top of the Tertiary plateau. The sandstone is of grey colour, and shews much false bedding. It withstands the weather well.

Fragments of white vein quartz are common in the sandstone, which is used as road metal. The dip of the beds is about 5 degs. to the northward. About $2\frac{1}{2}$ miles north of Casterton, opposite the quarry for road metal in a rock resembling dacite, a road cutting exposes the

beds dipping to the north-west at about 15 deg. Two miles north-west from Merino, at the Cemetery, the shale beds dip at a low angle to the south-west. Generally these beds appear to be nearly horizontal, and not to be much faulted, conditions that are favorable for boring. Considerable interest attaches to these beds on account of the result of two bore holes drilled in them many years ago by a local company. No. 1 bore cut a seam of coal 8 inches thick at 372 ft. 4 in. : total depth, 695 ft. 2 in. No. 2 bore is in the township of Merino, and about a mile north of No. 1 bore; at 42 ft. 9 in., 10 inches of coal was cut; at 89 ft. 3 in., 7 inches of coal; at 637 ft. 8 in., 1 foot of coal; and at 755 ft. 9 in., 1 ft. 6 in. of coal. The water which still flows from this bore hole is very salt. These results are most encouraging, and further bores should be drilled on this area. Mr. Howitt has reported a good site for further operations, close to the Cemetery, about 2 miles north of Merino. A very considerable amount of drilling is required, and the importance of obtaining a supply of coal in this part of the State would justify the expenditure.

Trachyte.

At Coleraine, as recorded by Mr. Ferguson, there is an outcrop of igneous rock resembling dacite on the north side of the river near the bridge. Mr. D. J. Mahony, M. Sc., has identified this rock as trachyte after microscopical investigation of a thin slice. It is of large extent, spreading out in a northerly direction. On the Harrow road, $2\frac{1}{2}$ miles from Casterton, there is a quarry $\frac{1}{4}$ mile west from the road, and from this a similar rock is obtained for use on the roads as metal. It appears to be of considerable extent, and possibly the whole ridge may be of this rock, which is of grey colour, much altered, and resembles some of the Lilydale dacite. Quartz veins occur in it. Height of quarry above sea-level, 500 feet. On the road to Harrow, and 8 miles from Casterton, a similar rock of grey colour also crops out. Experiments were made as to the possibility of using these rocks as "slips" or glazes, but they were found not to be suitable for that purpose.

Serpentine.

Six miles north of Casterton on the Harrow road there is a rocky ridge known as the Hummocks. The rock is serpentine, and it is said to be traceable for some miles in a north and south direction. No fine asbestos was observed, but a half developed variety occurs. Some of the serpentine might be used for ornamental purposes. At present it is being used as road metal.

Granite.

About 10 miles from Casterton on the Wando road, granite crops out in the bed of the Wando River; it continues for a short distance up the river, and is succeeded by a belt of schist about a mile wide. Then dykes of close grained granite rock cut through this schist. Height at this point, 550 feet above sea-level. Granite covering a large area shews on the Glenelg between Chetwynd and Harrow.

Ordovician.

At a distance of 7 miles from Casterton on the road to Roseneath, and opposite the Retreat Station, yellow slates and sandstones are exposed on the south side of the River Glenelg; similar beds are disclosed at Roseneath where the road ascends from the river, and also at Nolan's

Creek, $3\frac{1}{2}$ miles north-east of Roseneath. It is in the yellow slate of this age at Nolan's Creek that silver bearing ores have been found. The lode strikes a little west of north, and the ore ranges from 3 inches to 1 foot thick. A tunnel has been driven upon it for a short distance, but has since caved in. The ore lying at the surface consists of carbonate of lead with about 10 oz. of silver per ton. A sample taken for assay gave—Silver, 33 oz. per ton; lead, 47 per cent., and a trace of gold per ton. About 1 chain to the east is another small lode, on which a little work has been done. At this site the lodes could best be tested by means of a shaft. The Ordovician beds continue for $3\frac{1}{2}$ miles below the silver lode. At Wando Gorge, 10 miles north-west from Casterton, schists that probably represent Ordovician beds altered by granite occur. Along Nolan's Creek, marble, in a belt of about 12 feet wide, is met with.

[*Report sent in 12.6.08.*]

STONY CREEK, NEAR HALL'S GAP, THE GRAMPIANS.

By E. J. Dunn, F.G.S., Director, Geological Survey.

Hall's Gap is situated about 18 miles west of Stawell towards the northern end of the Grampians. The average dip of the sandstone on the east side of the Grampians appears to be about 9 deg. to the westward, but on the road from Hall's Gap to Stony Creek the beds in places dip as much as 30 deg. to the west. The dip-slopes are bared and prominently disclosed on the eastern side of Stony Creek near its junction with the main creek. On the Stony Creek Road, about half-a-mile from Hall's Gap there are red, purple and grey sandstones and a thick sheet of rock resembling the Snowy River porphyry. White sandstone occurs above this. About 100 feet higher in the series and $\frac{1}{4}$-mile further along the road there is another large porphyry sheet, apparently intercalated with the sedimentary rocks. The jointing of the sandstones is well shown on the exposed dip-plane on the opposite side of the creek: the strike of the main joints is about E. 35 deg. N. The road passes a waterfall about 25 feet high caused by the jointing, the strike of which is S. 12 deg. W. The joints are doubtless the cause of the north and south set of watercourses in this range of mountains. About $2\frac{1}{2}$ miles along the road from Hall's Gap, granitic rock intrusive into the sandstone is met with, and this rock forms the floor of the alluvial workings 3 miles from Hall's Gap. Dredging operations are being carried on at the site of old workings, but the results hitherto have not proved satisfactory. It is reported that some rich yields of gold were obtained here when it was first worked.

About three-quarters of a mile south-east from this site is another old alluvial diggings called Klondyke. There has been only a little work done here, and the depth from surface to bed rock is about 21 feet, the bottom being decomposed granitic rock. This lead is of Tertiary age.

Devil's Creek is about half-a-mile east of Klondyke. Here also only a little work has been done. Sinking is about 20 feet deep, through very rough and heavy bouldery wash. The bottom is decomposed granitic rock. High up among the sandstone some hundreds of feet above this spot and to the east of it, gold occurs which could not have been due to the presence of the granite. Where the granite is first seen on the road the beds of sandstone are altered to quartzite by contact metamorphism, showing the granite to be more recent than the Grampian sandstone.

The Stony Creek diggings are situate on a wide flat about 1,000 feet above Hall's Gap, and there appears to be a little gold dispersed through the washdirt everywhere. The gold obtained here is pale in colour, and worth about £3 12s. per oz.

Should the porphyry on petrological examination prove to be the same as the Snowy River porphyry, and interlaminated, then the Grampian beds would apparently belong to the lower Devonian series, and be below any beds likely to bear coal.

Obsidian buttons are occasionally found in the washdirt.

[*Report sent in* 17.2.08.]

PROPOSED BORING SITES AT BOGGY CREEK, MOUNT WILLIAM GOLD-FIELD, GRAMPIANS.

By A. M. Howitt.

The rocks in the vicinity of the Mt. William gold-field consist of granodiorite overlain by the Grampian sandstones; both in parts are covered by a varying thickness of Tertiary sediments.

The object of my visit was mainly to see the country in which some further boring was desired. Mr. Langdon kindly accompanied me, and we proceeded along the present line of bores, thence west to Langdon's claim on the Little Creek, where, I am informed, they can make about 15s. a man per week. Leaving this claim, we passed along Sawmill Creek for some distance, then branching off to the west, reached Pischoley's Gully, where a patch of about 13 ozs. of gold was obtained in a run amongst large granodiorite boulders. We then went in a south-westerly direction to Boggy Creek, near the Wannon-road, at a point where the hill sides approach one another to within about 11 chains; the one side is granodiorite and the other a made hill, with the Grampian standstones showing above. The two localities where boring is favoured on the Boggy Creek fall are—(1.) Near the present line of bores and above Langdon's claim. (11.) On Boggy Creek, one of the heads of the Wannon River.

Mr. Langdon considers that the first of these sites should be tested, as proposed bore No. 90 (3 chains north-west of No. 89) was not put down, and there may still be room for a deep run of wash to pass through between No. 89 bore and the outcrop of granodiorite on the north-west, about 10 chains away; and in support of this opinion he states that the gold in his claim appears to have its source from that direction. I consider that there is nearly sure to be shallow ground at proposed bore No. 90, as No. 89 bottomed at 27 feet; but unless this proposed bore No. 90 is put down there will be a doubt about the depth, since the distance from proposed bore No. 90 to the main outcrop of the granodiorite is about 10 chains. The surface indications point to the ground still being shallow, and a shaft would probably prove this without much expense.

The second site is on Boggy Creek at a point where the hills approach one another, and, below the junction of several small gullies with this creek, there is a site favorable for boring, as far as position is concerned, but the other points to be considered are doubtful.

In favour of this scheme it is urged that Boggy Creek is the only outlet for all the small gullies falling south-west from Mafeking West towards the Wannon River, and that these smaller gullies have prospects of fine

gold in many places, although as yet none of them have proved anything of a permanent payable nature, the best patch being that of 13 ozs., obtained in Pischoley's claim, amongst large granodiorite boulders. One of the small patches on this Boggy Creek fall was known as Duffer Rush. There have been no shafts bottomed near this site, so no estimate of the depth of the ground can be given. As the source of the gold appears to be in the granodiorite, there should be many gullies in which prospects might be obtained.

I do not consider that the gold so far obtained on this western fall has been of a sufficiently payable nature in the smaller gullies to warrant further boring on Boggy Creek.

[*Report sent in 30.10.06.*]

THE MT. WILLIAM GOLD-FIELD, GRAMPIANS.

By E. J. Dunn, F.G.S., Director, Geological Survey.

This gold-field lies about 15 miles north-east from the Willaura Railway Station. There were formerly two townships, known as the Lower and Upper Camps; the last-named is now called Mafeking and the former Ladysmith, as they were established at the time of the Boer war. Ladysmith is 1,200 feet above sea level; Mafeking is about 600 feet higher, and is situated on a plateau about 1½ miles west from Ladysmith. To the north, Mt. William, about 2½ miles distant, towers up to 3,827 feet above sea level. The rocks met with in this area are:—(1) The Grampian sandstones and conglomerates, probably referable to the Devonian system. (2) Granodiorite, or a fine-grained horneblendic, granitic, rock intrusive into the Grampian sandstones which in consequence, have been converted into quartzite and in some cases into rock that might well pass as quartz; pebbles of the metamorphosed sandstones abound near Mafeking. (3) Tertiary deposits, probably of Newer Pliocene age, consisting of mottled red and grey clays, sands, and conglomerate; the gravel at the bottom of such beds has been extensively worked for gold, and in many places was highly productive. (4) Recent alluvial deposits filling the gullies and creek courses; these have also been extensively worked for alluvial gold. The beds consist chiefly of Grampian sandstone and quartzite boulders and pebbles, drift, and sand immediately derived from the Tertiary beds in many cases. Generally there is little clay present, and the stones are very cleanly washed.

The Mt. William gold-field occupies a hollow at the southern foot of Mt. William, and the Grampian sandstones form a high rampart on the northern side. The floor consists of granodiorite from which the sandstones have been removed. A tertiary (Newer Pliocene) lead runs westward from the Gap to near the top of Bristol Gully, then sweeps northward round the head of Malay's Gully, through Emmett's Gully, down past Poverty Gully in a southerly direction, past Mafeking, through the May Queen claim, and through the Engine shaft, and runs out towards Neild's Gully. There appears to be a possibility that a western branch lead from near the head of Jimmy's Gully joins the main lead somewhere near the Engine Shaft. The known lead has been partially worked eastward of Bristol Gully. In Bristol Gully several shafts have been sunk, but I was informed that owing to heavy water they were not bottomed in most cases. From Malay's Gully to Emmett's Gully the lead does not appear to have

been worked. At Jamieson and Abrahams' claim the gutter of this lead is being worked, but southward from this claim it does not appear to have been worked. Browning's claim appears to have been on a branch where worked, and his tunnel has not been driven in far enough west to cut the main gutter, which should be met with about 200 feet further west. In Briggs and Anderson's claim the tail-race would have to be continued northward for a considerable distance to tap this lead. Southward from Browning's claim the lead might be followed for some distance, but it appears to have been cut into and denuded by Poverty Gully. At the township a portion appears to have been worked, and again at the May Queen Extended claim, and at the Engine Shaft. It is not certain how far south of the Engine Shaft the ground has been worked. It is desirable to determine whether a western feeder joins the main lead or not, and a few bores could also be put down where Neild's Gully runs into the flat in Allotment 87. As all the shallow alluvial gullies have long since been worked out, these points appear to be the only ones worth trying.

In working the alluvial gullies amethysts of small size and poor quality were found commonly in Neild's Gully and in Mason's Gully, and also in a small gully running into Jimmy's Creek from the east near its head. Small pieces of chalcedony were also common in Neild's Gully.

Obsidianites (Australites).

These remarkable bodies were met with in moderate abundance when working the recent gullies. From inquiries made it appears that they were always found in the washdirt, resting on the bed rock and not in the beds of sand and drift that covered the washdirt, nor in the surface soil, so that although they were deposited during the Recent period they have evidently not been deposited in the most recent period which reaches down to the present time. As to their occurrence in the tertiary beds the evidence is not quite so satisfactory; in only one instance could it be ascertained that obsidianites were found in beds of unmistakable tertiary age. In the one instance a spot was shown in the May Queen Extended claim where a specimen was picked out of the gravel. Some of these "obsidian buttons" were obtained in Mason's Gully and its branches, but they were far more abundant in Neild's Gully and in Jimmy's Creek branches.

Source of the Gold.

The principal source of the gold on this field is undoubtedly the granodiorite which underlies the whole field, and extends quite 3 miles further west than is shown on Mr. Herman's sketch map of the field. Over a great deal of the area the granodiorite is much decomposed, but hard bosses occur that are quite unaltered even at the surface. The more decomposed portions appear to be most productive of gold. Quartz veins up to 12 inches thick, and carrying sulphides of iron, &c., and gold intersect the granodiorite, and these must have contributed their share of gold to the alluvial deposits; but far more numerous are thin veins that ramify as a network in places through the bed rock. The breaking down and weathering away of these has fed the alluvial gullies. In Briggs and Anderson's claim, Emmett's Gully, gold is being won directly from the original rock matrix. The veins have been worked for a depth of 50 feet into the soft bed-rock; the general trend of the veins is about N. 20 deg. W., but they ramify in all directions. If this tail-race is continued further northward it will cut into the washdirt of the old lead. Wade and Kelly's reef is on the south side of Emmett's Gully. Shafts to depths of 60 feet

and 70 feet were sunk here. The quartz ranges from 2 inches to 12 inches thick; its strike is E. 10 deg. N.; dip 70 deg. S. It carries sulphides of iron and shows free gold occasionally. The yields are stated to have been about ½ oz. of gold per ton. Mr. Kelly also sunk some shafts on some leaders carrying gold and intersecting granodiorite at about 10 chains north-east from the middle of German Gully, which runs in a southerly direction into Mason's Gully. At about 50 feet from the surface the rock becomes hard, and unless the veins are rich they would scarcely pay to work in this hard rock. To the west of the head of Neild's Gully a tunnel was driven northward for 1,000 feet to prospect the alluvial ground southward from the Engine Shaft. At the mouth of the tunnel there are joints in the hard granodiorite. The faces of these show in parts copper pyrites, molybdenite, and iron pyrites as thin films, and probably gold is also present. Some narrow quartz veins were opened up about 25 chains further southward and close to the west side of Neild's Gully, near where it enters the northern boundary fences of the sold land. Another small vein has been opened up on Spion Kop at the head of Chirnside's Gully, and one or two attempts have been made to work these small auriferous veins further westward; but so far none of them have proved successful, and they are for the most part so small that they could not be profitably worked unless they were rich in gold. Although the granodiorite extends for 3 miles further west than shown on the sketch map mentioned above, no gullies have been worked for gold over that area. The rock is very hard, and this may be the reason why such hard rock appears less productive of gold than the decomposed portion of the mass. Eastward of the productive area the hard granodiorite extends also over a wide tract, but no auriferous gullies have been worked there. Probably a considerable depth of the granodiorite has been removed to produce the gold deposited in the old lead, and this old lead has again been denuded, and, together with further gold derived from the veins in the granodiorite, has furnished the gold found in the recent gullies. It is quite possible that some of the conglomerite beds of the Grampian series may have furnished a little gold, but it is not likely to be of much consequence. The field is of considerable interest, and it should be surveyed when an officer can be spared. There are other outcrops of granodiorite in the Grampians that may prove to be auriferous. The alluvial workings near Hall's Gap is similar as regards the origin of the gold.

[*Report sent in 23.4.09.*]

LORD NELSON NORTH MINE, ST. ARNAUD.

By E. J. Dunn, F.G.S., Director, Geological Survey.

This mine is situate about a quarter of a mile north from the post-office, and about 12 chains west from the Lord Nelson shaft. The outcrop of the reef worked in both these mines is about 500 feet east of the Lord Nelson North shaft, which is 2,150 feet deep. At the 1,830-ft. level the reef crosses the shaft and dips 75 deg. to the west. The strike of the reef is N. 30 deg. W. The slate and sandstone beds dip west about 80 deg. and strike the same as the reef. There is a cross-cut east 40 feet long to the boundary of the lease. On the course of the reef a level is driven north for 200 feet and south for 350 feet. At

the face in the south level the reef is 4 feet thick. The shoot of gold would be about 50 feet further south. For about 120 feet above this level the shoot of auriferous quartz has not been worked, but will probably be stoped out by the Lord Nelson Company shortly. At the 2,085-ft. level the cross-cut is run out south-west and the reef was cut at 360 feet from the shaft. At right angles from the shaft the distance to the reef channel would be about 200 feet. About 20 feet east of the reef is a dyke 10 inches thick, which runs about parallel with the reef. The reef is 1 ft. 6 in. thick where the cross-cut intersects it. Southward a level has been driven 700 feet along the reef. At 300 feet from the cross-cut the reef is about 4 feet thick, and is said to be payable. It widens out in places to 10 or 12 feet thick. At the end the reef has pinched again, the shoot going underfoot, as they all appear to pitch south. This shoot has been worked from the surface down to within 120 feet of the 1,830-ft. level of this mine in the Lord Nelson mine, and it has yielded a large amount of gold. At 320 feet from the south end of this level a winze is down 15 feet; it is to be sunk to 200 feet. The quartz at the south end of this level is stated to have yielded 8 dwts. of gold per ton of quartz. It is intended to sink the shaft another 200 feet, so as to stope the reef upwards from that level. The gold is worth about £3 5s. per oz.

[*Report sent in 4.3.09.*]

THE LORD NELSON MINE, ST. ARNAUD.

By E. J. Dunn, F.G.S., Director, Geological Survey.

At the surface, and within the lease, is a prominent outcrop of quartz, and the main shoot worked in the mine commences at the south end of this outcrop and pitches southward. The length of the shoot of payable quartz near the surface is 900 feet; in No. 19 level the length is 300 feet only, but it appears to again lengthen in the North Nelson mine.

The shaft is 1,895 feet deep, and at the bottom level (No. 19) a cross-cut runs south-west for 450 feet, where the reef was cut. The beds of sandstone and slate strike N. 35 deg. W., and dip westwards at 80 deg. The reef appears to have the same general strike as the country, except where it bulges, but the dip is flatter than the containing beds, being about 70 deg. to the west. About 7 feet of the reef is payable at this point. A loop forms in the reef at this site that commences 20 feet north of the cross-cut, and that rejoins the regular channel at 176 feet south of the cross-cut. On the footwall the reef is 1 ft. 6 in. thick. The shoot goes underfoot at the south end of the loop. In the stopes 12 feet above this level the reef is 7 feet thick, and in the north end of the stope, which is 20 feet long, the face shows 8 feet of quartz.

At the 1,675-ft. level the cross-cut is driven diagonally west. The country dips west, and the reef also dips west, and is 8 feet thick. At 150 feet north from the cross-cut the shoot of quartz cuts out and goes overhead. The level continues northward for 250 feet from the cross-cut. The hanging wall which is very regular strikes N. 35 deg. W., and dips 75 deg. W. The reef runs with the strike of the country, but in dip it conforms with it in some parts and crosses it in other parts.

At the No. 13 level, at a depth of about 1,270 feet, the cross-cut is driven west for 200 feet to the reef, which is 40 feet thick, consisting of quartz and country rock. There are five different veins of quartz in this thickness that are being worked. The footwall line is well marked, and coincides with the bedding. Strike N. 35 deg. W., dip 72 deg. W.

The main shoot of auriferous quartz has been practically worked out to the No. 18 level. There still remains the portion of the shoot between the Nos. 18 and 19 levels, or 120 feet in depth, to stope out.

[*Report sent in 12.3.09.*]

BROWNING'S LUCK, ST. ARNAUD.

By E. J. Dunn, F.G.S., Director, Geological Survey.

This mine is about half-a-mile south-west from the Lady Nelson mine. The shaft is sunk to a depth of 800 feet. The country rocks consist of slates and sandstones that have undergone some changes due to metamorphic action, and the reefs appear to conform with the beds in strike and to a certain extent in dip also. There are two reefs proved, the Little Reef and the Main Reef. To the north of this mine is the New Chum mine, in which a profitable shoot of auriferous quartz pitching south was worked. The upper workings in the reef of this mine are said to have been profitable. The shoot from the New Chum does not appear to have been yet cut in this mine.

At 600 feet from the surface the Little Reef is just on the west side of the shaft. There is no eastern cross-cut at this level; the western cross-cut cuts the main reef at 70 feet from the shaft, and a level is driven north on this reef. At 200 feet from the cross-cut stopes have been worked up to the 500-ft. level. At 230 feet from the cross-cut a winze has been sunk to the 800-ft. level. At about 420 feet in, the quartz reef is 2 ft. 6 in. thick and the reef has been stoped overhead. Both the country and reef dip west. South of the cross-cut the level has been driven on the course of the main reef for 53 feet. The reef is 3 feet thick, but in the face it is small and broken.

At the 800-ft. level a short cross-cut is driven eastward, and from the end of this a hole was drilled still further east for 1,401 feet. The beds dip west at about 80 deg. A west cross-cut cut the Little Reef at 120 feet, and then the Main Reef at about 160 feet from the shaft. A level is driven northward on the course of the Main Reef, and at 250 feet a winze is sunk to a depth of 60 feet below the 800-ft. level. At 400 feet in. this level ends. Three inches of quartz shows in the face. This level is not extended far enough north to meet the New Chum shoot worked further to the north in the adjoining mine. Stopes for 30 feet high and for a length of about 100 feet have been taken out in this north level. The west cross-cut is altogether 160 feet long, but it does not cut the reefs at right angles.

[*Report sent in 3.3.09.*]

WALKER'S MINE AND OTHERS AT ST. ARNAUD.

By E. J. Dunn, F.G.S., Director, Geological Survey.

Walker's Mine, St. Arnaud.

About three-quarters of a mile north from the Lady Nelson Mine is Walker's (the Lady Nelson Extended) Mine, from which all plant and machinery have been removed. A great deal of shallow work has been done on the hill-side, and fossickers are still at work following spurs that ramify through the country rock for about 2 chains in width. The rocks consist of slate and sandstone that appear to be nearly vertical in dip, and the strike of which is about N. 30 deg. W. The gold found in these workings is worth £4 per oz. No records are available to show what results were obtained from this shaft, which is 200 feet deep.

The Comstock Mine, &c.

About 25 chains northerly from Walker's Mine is the Comstock where the shaft was sunk to a depth of 300 feet. At the Comstock there is much black slate inclined at a high angle. In this mine much silver is said to have been discovered, but there are no records of the gold and silver won. The gold is said to have been of very low grade. Surface workings connect Walker's Mine with the Comstock Mine, and this strip of country appears deserving of more exploration than has been carried out.

About 15 chains north of the Comstock are other surface workings where the spurs gave as much as ½ oz. of gold per ton of quartz. These spurs have been worked over a length of about 5 chains; they occur in beds of very favorable appearance, the black slate being thickly studded with iron pyrites. At the north end of these workings a shaft has been sunk 200 feet, but very little work was done from it. From this point alluvial gullies have been worked northward. Six chains north-east from the shaft is the Silver King shaft, 70 feet deep, from which it is reputed rich silver ore was obtained. There has been very little work done from this shaft The shaft is on the south boundary of a 20-acre block.

This tract of auriferous country deserves far more attention than has been bestowed upon it. Walker's Mine appears to be especially suitable for further prospecting.

[*Report sent in 24.2.09.*]

The Dodger Workings, St. Arnaud..

On the edge of the Mallee and about 3 miles north-east of St. Arnaud are the Dodger workings, where a series of flat spurs has been mined. The quartz is of grey colour, and it breaks up into angular fragments. These spurs are up to 2 feet thick and they are so close together as to form a considerable proportion of the whole mass of rock. The country consists of white pipe-clay and white sandstone of a friable nature. A great deal of work has been done in shallow holes, and the quartz was crushed at a small battery which is about half-a-mile to the east of the workings. It is stated that the spurs become productive when they crossed indicators. There appears to be room here for much more prospecting. Yields of about ½ oz. are said to have been obtained from some of the quartz crushed.

The Red, White, and Blue Claim, McManus's Paddock.

This claim is about north-east from St. Arnaud, and 7 miles distant by the road. At this site there are some favorable looking quartz veins, the principal traceable for a few hundred feet in length. A shaft has been sunk 56 feet on it and some shallower holes have also been sunk The strike of the principal vein is N.W., dip E. The quartz is saccharoidal, and 15 inches thick. The gold is crystalline in character, and worth about £4 per oz. An interesting feature is that carbonate of bismuth is associated with the gold. Eight and a-half tons of quartz crushed yielded 1 oz. 18 dwts. of gold per ton, so the prospectors informed me. The country around consists of low undulations, and it is probable that other auriferous veins exist. The gullies do not appear to have been tried for alluvial gold. Messrs. Roberts and Byerly are working here.

McManus's Reef.

This reef is five chains to the west of the Red, White, and Blue claim. The country rock is reddish altered sandstone and slate. Distinct alteration is observable in some of the beds, and the appearances suggest that granite is at no great depth beneath. The strike of the reef is N.W., and its dip is N.E. It is from 12 inches to 3 feet thick, and in parts carries iron pyrites as well as a little carbonate of bismuth. This locality deserves further prospecting, but operations are hampered through the land being private property.

The Little Boulder Claim.

This claim is about 4 miles from St. Arnaud, in a direction a little east of north. It is right in mallee scrub, and is about 2 miles westerly from the Dodger Claim. The country rock is pipe-clay and soft, white sandstone. Flat spurs, which dip W. and pitch S., cut through the country. The thickest spur is from 3 to 4 feet thick. This also appears to be "indicator" country, and where the spurs cut the indicators the quartz is payable. Yields of 14 dwts. per ton have been obtained, and only shallow surface work has so far been done. Mr. R. Love is at present working here. The locality deserves to be prospected further.

The Bell Rock Mine.

This mine is about one and a-half miles north-east from St. Arnaud. The country rock is grey and black slates and grey sandstones, and the soil is red. The shaft is 450 feet deep. The Bell Rock reef strikes about east and west and dips 69 deg. S. It is from 3 to 4 feet thick. There is also a north and south reef that has been worked in shallow excavations northward for 200 feet from the east and west reef. The best quartz is said to have occurred where the two reefs joined. The north and south reef is very irregular, and appears to be a series of spurs in sandstone rather than a true lode. This mine has not been worked for many years.

The Black Rock Mine.

About 5 chains east of the Bell Rock shaft is the Black Rock shaft. The strike of the reef, which appears to have been about 2 feet thick, is N. 35 deg. W. The reef was well formed and regular; dip W. at 80 deg., and further south in the workings it is 65 deg. W. An alluvial gully running east has been worked. There appears to be room here for further prospecting. No mining has been carried on for some years in these shafts. In this neighborhood the following quartz mines were

formerly worked:—The Prince of Wales, the Garibaldi, the Duchess of Edinburgh, the Victoria, the Hope, and the Hopeful. They all lie south-easterly from the Bell Rock shaft.

Collis' Flat.

About one and a-half miles from St. Arnaud in a direction W. 10 deg. S. is the head of an alluvial shallow lead that runs eastward. Shallow alluvial workings also extend to the north-west from this point. It is evident that this neighborhood must have furnished the gold for these leads, but so far no payable quartz has been found except at Clarke's Reef, which is about 10 chains south-west from where the alluvial gold ceases. Besides the shallow ground there was a deeper gutter at the head of the workings.

Clarke's Reef and The Evening Star Reef.

This reef strikes N. 30 deg. W. and dips E.; the pitch is south. The country rock is yellow sandstone and slate, and spurs of quartz up to 12 inches thick ramify through the sandstone. The spurs have been worked to a depth of 80 feet, right in centre country, and the beds dip east and west away from the portion mined. About one quarter of a mile to the northward from Clarke's reef, and on the same anticline, is the Evening Star reef worked only to a shallow depth. There is room here for prospecting in centre country. The country is of a most favorable character, and it appears, like all the country south of St. Arnaud, to be Ordovician of newer character than the rocks that occur to the north of St. Arnaud. The southern pitch of the auriferous shoots accords with this view.

Prince Charlie Mine.

This mine is about a quarter of a mile south on the same anticline as Clarke's reef. The country rock is pink and yellow sandstone and slate, striking N. 30 deg. W.; the dip at the shaft is E., but changes to W. close by. The shaft was sunk 200 feet, and gold was got down to 80 feet from the surface in spurs in sandstone. The pitch of the shoot was southward. Nothing is being done on this line.

Queen Mary Mine.

On the East Navarre-road, and about $3\frac{1}{2}$ miles from St. Arnaud, is the Queen Mary shaft, 180 feet deep. Formerly a considerable amount of work was done here and good returns are reported. There is much ferruginous stone at the surface, and the beds consist of red, yellow, pink, and grey sandstones and slate, almost vertical in dip. Alluvial gullies have been worked radiating from this spot, but at present no work is being done. This locality also deserves further attention. The gold from the reef was worth £4 1s. per oz. Northward on the same line of reef and about one mile distant, are the Cherry Tree and Jardine reefs. Southward, on the same line of country, are the Jerijaw workings.

The American Eagle Claim.

About 4 miles south-west from St. Arnaud, and almost due west of the Queen Mary Reef, are the workings being carried on by Messrs. Balmer and party. The country rock is grey and yellow sandstone

intersected by quartz spurs up to 1 ft. 6 in. thick. The quartz here yields about an ounce of gold per ton. A shaft is sunk to 50 feet in depth, and there is ample room for further prospecting.

The John Bull Reef.

This reef is being worked by Messrs. Lane and Smith, and is about 5 miles south-west from St. Arnaud. The strike of the reef is N. 30 deg. W., and the dip is slightly to the east. The country consists of pink and grey sandstone of Ordovician age, probably high up in the Castlemaine zone. The reef ranges from 1 inch to 3 feet thick, and it yields about 1 oz. of gold per ton, worth £4 per ounce. A shaft has been sunk to 150 feet in depth, and a small crushing plant is erected on the mine.

The Tommy Dodd Reef.

This mine is about 15 chains east from the John Bull reef. The country is of similar character. The reef is about 2 feet thick, and averages about 1 oz. of gold per ton. The reef is worked for a length of 300 feet. The Jerijaw mine is about a mile and a-half south-east from the John Bull mine.

General Remarks.

The country around St. Arnaud consists of rocks of Ordovician age, which have a general pitch to the south, so that the lowest beds are exposed in the mallee country north of the township; beds higher in the series appear at St. Arnaud and still higher beds to the south. The beds in mallee country greatly resemble the pipe-clays and white and grey sandstone of the Lancefield series or of the lower Bendigo beds, while the beds met with southward from St. Arnaud at Clarke's reef, the American Eagle, the John Bull reef, &c., suggest Castlemaine beds. No fossils, however, were discovered that would fix the horizons. The shoots of gold appear to have a general southerly pitch, and as they usually conform to the pitch of the country it appears as though the whole series of beds was pitching southward. In McManus's paddock distinct metamorphic action is observable, and also in the beds to the north of St. Arnaud. A very noticeable feature along the course of the Lord Nelson reef, at the surface, is the tendency to form abnormally large masses of quartz. Wilson's Hill is formed of one of these bosses, and Sebastopol Rock is another and very conspicuous example. Fortunately a reserve has been made of the land around the Sebastopol Rock, and if the surface excavations were filled in and the young trees allowed to grow up it would regain its original interesting and remarkable appearance. St. Arnaud was noticeable when mining first began for the discovery of silver ores, and the gold bears testimony along a belt about one mile wide to the presence of much silver. It has, however, not been found profitable to mine for this metal. As an auriferous district it possesses great potentialities, and there are numerous sites where further operations should be undertaken. It is a good mining centre, and it is to be deplored that large tracts of country around the town, which should have been reserved for timber and for mining purposes, are fenced, the timber destroyed and the prospector discouraged, and a thin crop of poor grass only has been gained instead.

[Report sent in 5.3.09.]

THE LADY NELSON MINE, ST. ARNAUD.

By E. J. Dunn, F.G.S., Director, Geological Survey.

This mine is about 1 mile north of the Post-Office, St. Arnaud. The rocks consist of grey sandstone and slate; they strike about N. 35 deg. W., and dip west. A shaft has been sunk to 800 feet from the surface. East of the shaft is a low ridge, and rising about 20 feet above the surface of the ridge is a massive outcrop of quartz known as the Sebastopol Rock.

At the 203-ft. level, and 50 feet from the shaft in the west cross-cut, a "back" occurs that has a strike of N. 20 deg. W., and that dips W. 85 deg. At 60 feet west is a barrel-shaped roll in the beds with a little quartz over it; the pitch is south at 85 deg. The rocks forming this roll consist of black slate and grey sandstone. In a short level driven along the roll southward the beds consist of black slate and grey sandstone dipping W. at 85 deg. The quartz reef was worked along the level northward from the shaft. At 80 feet north is a rise connecting with the 100-ft. level. At 90 feet, a winze was sunk connecting with the level below, and a cross-cut was driven east for 16 feet, and here the beds dip east. This north level is along the lode channel, and the reef was worked at the north end right through to the surface. From this level the shoot was nearly vertical up to the surface, although the general pitch of the shoot is southward.

At the 274-ft. level, the reef channel is about 10 feet west of the shaft. The beds dip west at 85 deg., and the lode channel appears to conform generally to them. At this point the channel is about 2 inches thick. Northward, the reef gradually thickens. At 100 feet north, a winze connects with the level below. The reef was stoped out overhead and underfoot. Further northward, a curious admixture of black slate and quartz occurs, and forms a rounded mass; this was too poor in gold to work, and is not a saddle reef. Adjoining this abnormal mixture of quartz spurs and black slate the foot-wall shoot has been worked through to the level below and right down to the 700-ft. level. The pitch is south at a high angle.

At the 364-ft. level, the reef channel was cut at 20 feet west of the shaft. The country dips west at 80 deg. At 70 feet in the cross-cut west from the shaft another quartz reef 5 feet wide was cut; much country rock is mixed with the quartz, and it is too poor to work. At 80 feet south from the shaft the reef is stoped for 30 feet in height and for a length of 60 feet. In the level, 20 feet west of the shaft and 50 feet foot.

At the 464-ft. level, the country dips west about 70 deg. The reef channel is cut at 60 feet west of the shaft, and at 30 feet north of the cross-cut the quartz is stoped up to the level above and downwards. The shoot was about 60 feet long.

At the 562-ft. level, the country dips west at 70 deg. At 100 feet west from the shaft in the cross-cut the reef channel was cut, and the quartz has been stoped overhead and underfoot. To the north of the cross-cut the stopes extend for 35 feet, and to 20 feet south of the cross-cut.

At the No. 7 level, and at 130 feet west of the shaft, the cross-cut intersects the reef channel. The shoot of auriferous quartz was stoped for 40 feet north of, and for 10 feet south of, the cross-cut. The west cross-cut is extended a total distance of 210 feet from the shaft, the last 80 feet in country rock. The beds dip west about 70 deg. throughout the cross-cut.

At the No. 8 level, the west cross-cut intersects the reef channel at 158 feet from the shaft. The lode is 9 feet thick, and consists of quartz spurs and country rock commingled. The level is driven south 111 feet from the cross-cut along the lode, and at the end the shoot appears to pitch underfoot. In the east cross-cut from the shaft a channel is cut 91 feet from the shaft. Both country rock and lode dip west at about 70 deg. This channel is supposed to be the northern continuation of the Lord Nelson reef, and if the Sebastopol Rock at the surface represents the Lord Nelson reef, it would be so, for the channel is in the right position as regards dip for the continuation downwards of the Sebastopol Rock. The material in the channel consists of quartz and black slate with a tough clay (pug), and is a few inches thick. The cross-cut is continued 303 feet east of the shaft, and the country rock all dips west. Some of the beds nearly approach the vertical.

The one shoot of auriferous quartz worked from the surface to the bottom level in this mine was known at the surface as Higgins' Reef. The strike of the reef is about N. 25 deg. W., and the dip west. The pitch of the shoot is to the south, at a high angle. The original outcrop of the shoot was 200 feet north of the shaft. The richest quartz was got from the surface to a depth of 200 feet, and alluvial gold was found in the gully that runs northward from the east side of the outcrop. The reef gold of the Lady Nelson Mine is worth about £2 10s. per ounce. At 300 feet northward from the Sebastopol Rock is a long open cut, formerly worked by the Sebastopol Company, and it is reported with good results. The strike of this reef, which is in the same channel as the Sebastopol Rock, is N. 35 deg. W. The thickness of quartz worked was about 7 to 8 feet, and this was followed down for 150 feet; the shoot is about 200 feet in length. At the No. 8 level in the Lady Nelson Mine it would be desirable to drive northward along the channel east of the shaft, so as to intersect the downward continuation of the shoot worked by the Sebastopol Company. From the Sebastopol Rock, 300 feet eastward, is the American shaft, which is 200 feet deep, with three compartments, and well timbered, and 150 feet north of this shaft are Ben Whiteley's workings. At this site yellow sandstone beds are traversed by thick quartz spurs with much limonite associated with them; the soil is red. Thousands of loads have been removed from the surface quarry, and the workings have been carried to some depth in an irregular manner. This auriferous outcrop is bounded by nearly vertical grey slate walls running east and west. The American shaft was sunk with the object of cutting these spurs at a depth. As the dip of Whiteley's workings appears to be west, the continuation downwards ought to be commanded by the Lady Nelson shaft.

[*Report sent in* 24.2.09.]

Since my previous report, the north level at 800-ft. has been driven along the Black Reef for 255 feet from the cross-cut on what is considered to be the west wall, and which is evidently the main wall of the channel. At 150 feet from the cross-cut a wall diverges from the channel at a small angle; this is supposed to be the east wall. From this point to the face of the level, slices of quartz occur with the country between the two walls, but the quartz is not auriferous except at one point; this is 31 feet north of where what is considered to be the east wall diverges, or 181 feet from the cross-cut. Here the quartz is of grey colour, and different in appearance to the rest of the quartz met with.

It is 8 inches thick, and carries payable gold. The small vein is bent, and until driven upon the value cannot be determined, but it certainly is an encouraging feature.

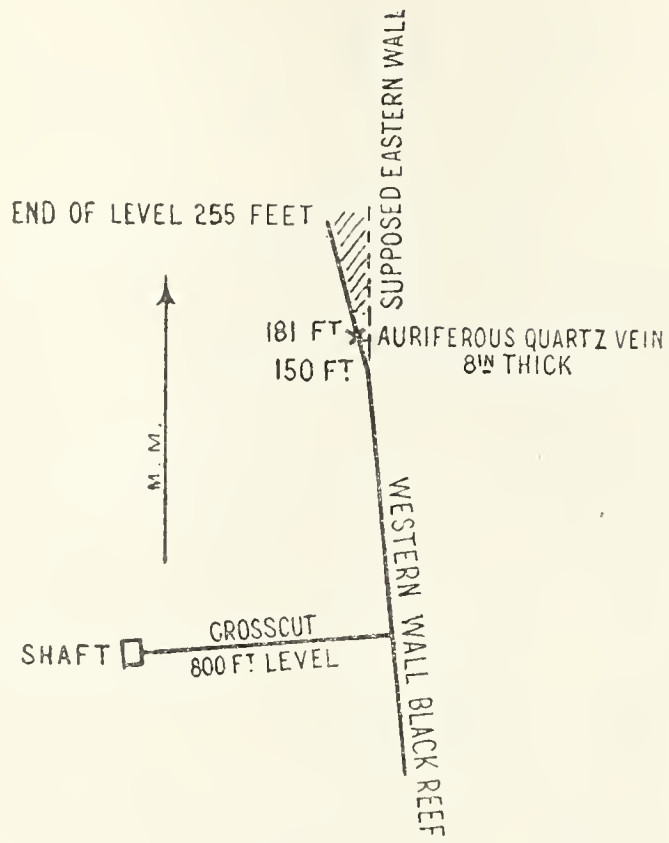

FIGURE NO. 17.

SKETCH PLAN OF THE LADY NELSON MINE, ST. ARNAUD, SHOWING POSITION OF AURIFEROUS QUARTZ VEIN.

The most pressing work to be done is to open out with the object of tracing this vein northward. Overhead, there is also 200 feet of unexplored country, and possibly favorable indications may lead up into this.

[*Report sent in* 14.10.09.]

THE LADY NELSON MINE, ST. ARNAUD.

By H. S. Whitelaw.

The Lady Nelson Company possesses four leases (Nos 4926, 3921, 5103, and Tailings Lease No. 233) surrounding Sebastopol Hill, about 1 mile N.N.W. of the town of St. Arnaud. The workings to be described are situated about the centre of Lease No. 4926. Traversing these leases, generally in a north-westerly direction, are groups of reefs which have been profitably worked from the surface to water level (see report on St. Arnaud goldfield, 1898*). At the time of my visit attention was being paid to only two of these, the Rotten or Lady Nelson reef and the Black or Sebastopol reef.

Detailed plans and sections were made, and these will be published at a later date.

ROTTEN REEF.

The Rotten reef at the surface is 20 feet west of the main shaft, and can be traced from the south boundary of the lease to Armenian Gully,

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Whitelaw, H. S., Report on the St. Arnaud Gold-field. Spec. Rept., Dept. Mines, 1898.

where its outcrop is covered by surface deposits. Its general strike is N.W. by N., and its dip (below 200 feet) to the south-west at 64 deg. to 83 deg.; above 200 feet its dip is to the north-east at 78 deg. to 89 deg. The walls, which are usually smooth and firm, are seldom parallel for any considerable distance, and, consequently, the reef in different parts varies in width from 1 foot to 24 feet. The reef material is composed of greyish-white quartz and crushed and altered country rock. The quartz occurs in the form of shoots, in some places filling the entire space from wall to wall, as in the upper levels; in others confined to smaller limits, as, for instance, in the lower levels, where the bulk of the vein-filling between the walls (which are in places 20 feet apart) is silicified country rock. The shoot (called "The Mass") worked in the Lady Nelson Mine was 60 to 100 feet long, and of an average width of about 5 feet. Little is known as to its value between the surface and 200 feet in depth, but it is stated to have been richer than the portion below water level. The records supplied to me by the legal manager (Mr. J. A. Thorn) show that 10,889 tons crushed since the company was formed in August, 1903, yielded 3,565 ozs. of gold, an average of about 6 dwts. 13 grs. per ton. The shoot was payable, and has been worked out to No. 6 level. Below that it has been prospected at No. 7 level where the foot wall has been driven on 40 feet south, and the head wall 100 feet; and at No. 8 level where the foot wall has been driven on 270 feet, and the head wall cut across to at intervals. The yields from these levels were disappointing, the last from No. 8 (the stone broken while driving the level south) being 630 tons for 37½ ozs. The fissure in which this reef has been formed is a line of faulting, and probably extends indefinitely downwards. The movements caused by the faulting have in places produced a complicated convoluted structure in the slates and sandstones adjacent to the reef, and further complications have been caused by slides of small throw. At several places along the reef channel a series of rocks thinner-bedded than others adjoining them can be seen to be more curved against the wall than the massive beds, and at these places cavities have formed between the bedding planes, and here bodies of quartz have been deposited in forms simulating steeply-pitching saddle reefs.

The country rock exposed in this mine is composed of closely-packed, steeply-dipping Ordovician sandstones and slates, the former vastly predominating. Over the whole length of the line of section, and some hundreds of feet further eastward, there is a persistent dip of the strata in a south-westerly direction, and the survey tends to show that the country rock of this particular locality is not folded into anticlines and synclines in the regular manner in which it is at Bendigo. The apparent folding at several levels in the mine is a feature that may be ascribed with much probability to a deflection of the normal strike of the beds caused by faulting, which has dragged the edges of the strata into loops or sharp curves. These loop-like folds are best seen at the Nos. 2 and 3 levels. The plan of No. 2 level shows that on the east side of Rotten reef and the west side of the fault near the Western reef (at 90 feet west of the shaft), the strata strike north-westerly (which is the normal strike of the strata of the district), while between these two boundaries the beds are contorted, and the strike is deflected so as to run almost at right angles to the natural course. It would appear that this block of country has, subsequently to the tilting of the strata, been subjected to immense pressure, and the beds enclosed between the two faults have been curved and incurved against the walls as the result of horizontal drag. In the main cross-cut at 80 feet west of the shaft, a

saddle-shaped quartz deposit is to be seen on one of the contortions, and at the north end of No. 3 level a vein of quartz has been worked for about 60 feet around another one. At both places the quartz was unpayable. At lower levels similar features can be seen. At No. 8, 180 feet south of the main cross-cut, the saddle-shaped form of a small formation is clearly seen to be due to twisting; it occurs between the head- and foot-walls of the Rotten reef.

Black or Sebastopol Reef.

This reef is supposed to be the northward continuation of the famous Lord Nelson reef. It runs roughly parallel to the Rotten reef and about 320 feet to the eastward of it. It is composed generally of bluish quartz, but, in places of the crushed country through which it passes; this, where it is a carbonaceous slate, exhibits a blue-black appearance which has obviously suggested the name of the reef. It is comparatively small in itself (the conditions for ore deposition seem to have been more favorable in the fractured rock on the foot-wall side, and the Black reef perhaps served as a channel for the percolating waters), but associated with it on the eastern or foot-wall side is a massive spurry formation called the Sebastopol reef on which a large amount of work has been done. Most of the work was carried on by means of a large open cut, and, if one may judge from the amount of work and the thorough manner in which it was done, the shoot of gold worked from the surface to 200 feet was a rich one.

At the surface the shoot was about 35 feet in length and 20 feet in width. In depth it gradually shortened and narrowed, till at 206 feet it was only about 20 feet in length and 2 feet in width and was not payable. This formation on the eastern side seems to have no definite limits; it is situated in a much fractured zone bounded on the west by the Black reef and on the east by the Armenian reef. Between these two the country consists mainly of sandstone and irregular deposits of more or less auriferous quartz. One block of this having better withstood weathering than the surrounding country, now forms the crest of Sebastopol Hill. It is known as "The Pinnacle," and is a marked topographic feature of the district. The Lands Department has reserved a quarter acre of land surrounding it. The downward continuation of the Black reef has been cut in the No. 8 crosscut at 90 feet west of the main shaft. Here it is composed chiefly of silicified country rock between polished walls of carbonaceous slate. To the eastward of the reef channel—where the downward continuation of the Sebastopol reef should be found—the massive sandstone beds contain quartz spurs, but not in such profusion as on the surface. The longitudinal section shows that to get under the downward continuation of the shoot worked from the surface in the Sebastopol reef formation it will be necessary to drive northward on the Black reef.

Queen Zimmerimas Reef.

The position of this reef is to the west of the Rotten reef. It has not been worked by the Lady Nelson Company, but is mentioned here as the manager of the Lady Nelson mine (Mr. T. Cornelius),

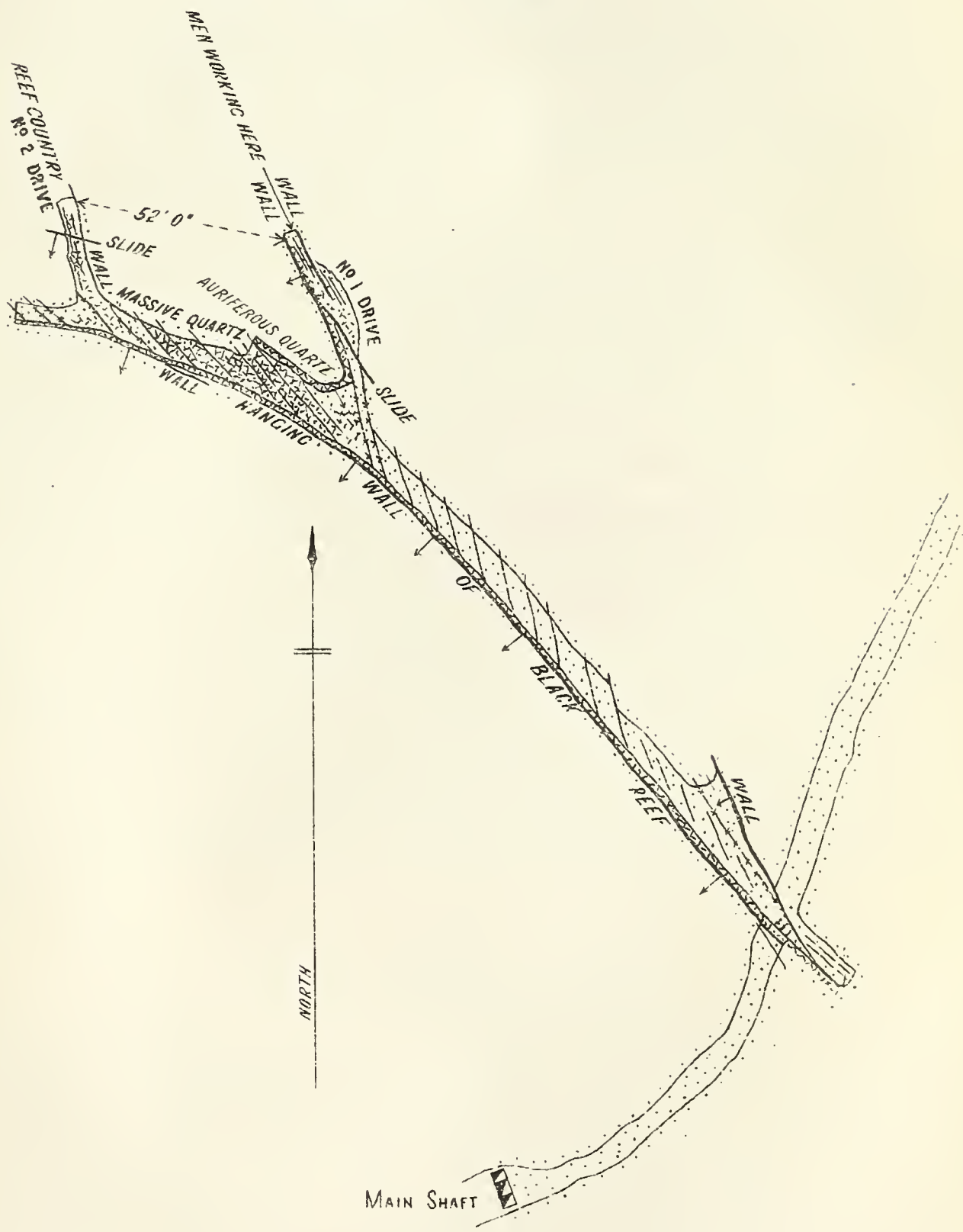
who worked on it to a depth of 300 feet in the new Zimmerimas shaft, has proposed to cross-cut westward from the Lady Nelson mine and prospect it at a greater depth than the bottom level of the Queen Zimmerimas mine. Owing to the entire absence of statistics nothing is known of the yields obtained from this reef. However, Mr. Cornelius informs me that it was rich from the surface to about 400 feet in depth. The rich shoot was worked out on the underlay from the old shaft to the new shaft through which it passed at a depth of about 320 feet below the sill. From here the new shaft followed it downwards on the underlay to a depth of between 500 and 600 feet. The quality of the quartz below 400 feet is not known, but it is said to have been payable to the bottom of the workings. The strike of the reef varies from N. 34 deg. W. to N. 57 deg. W.; the pitch of the shoot of gold is to the south-east, and, if the depth given me is correct, the dip from the surface to 300 feet is at an angle of 67 deg. to the south-west. When these figures are plotted they show that the No. 7 crosscut in the Lady Nelson mine is the best placed for cutting the downward continuation of the Queen Zimmerimas shoot. This crosscut is out westward about 190 feet, and, according to my plot (which assumes the dip to be regular), will have to be extended to 450 feet from the shaft, that is, an additional 260 feet of driving. It will be observed that the strike of this reef forms an angle with the strike of the adjacent reefs; it converges with the Western and Rotten reefs going southward, and appears to junction with the former at 530 feet and with the latter at 670 feet from the main shaft. The strike of the Black reef is coincident with the bedding planes of the strata; the Rotten and Western reefs strike more or less with the jointing or rude cleavage planes of the country; and the Queen Zimmerimas reef intersects both.

The result of the survey tends to lead to the conclusion, in the case of the Rotten reef, that, as the bottom level has intersected the shoot of quartz where it is low grade in value, success is more likely to follow sinking than driving. If the latter be engaged in, it must be for the purpose of discovering an unknown shoot; if sinking be proceeded with, the object will be to test at a greater depth a known shoot that has proved payable for some hundreds of feet in depth. The indications that suggest that sinking will justify confidence are: (1) the regularity of the walls, (2) the increased width of the reef channel (compared with Nos. 6 and 7 levels), and (3) the fact that the deeper the reef is explored the more strongly it becomes impregnated with metallic sulphides (galena, pyrites, &c.). The reef has a distinctly more inviting appearance at No. 8 than at No. 7 level. In the case of the Black or Sebastopol reef the appearance of the formation and the result of prospecting at the 206-ft. level (Sebastopol mine), suggest that the good quality of the quartz already mined may be due to superficial enrichment; but, as the north level on the Black reef at the No. 8 level from the Main shaft has not advanced sufficently far in that direction to meet the downward continuation of the shoot of gold worked on Sebastopol Hill, the extension of that level for 200 feet would be good prospecting work.

[*Report sent in 20.4.09.*]

Nº 8 LEVEL
LADY NELSON MINE
St ARNAUD.

Scale – 60 Feet to 1 Inch.



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NATURAL HISTORY

I have now brought up-to-date the survey of the Lady Nelson mine, St. Arnaud. Since my previous visit in March, the No. 8 level north has been extended 190 feet on the Black reef, the total length of the level now being 238 feet from the cross-cut. The country (crushed quartz, slate, and sandstone) passed through in this level is similar to that described in my previous report, and showed no encouraging feature until a point 150 feet from the main cross-cut was reached. Here in the V-piece between the Black reef and a west-dipping wall diverging from it at an angle of about 40 deg. in strike, a vein of quartz 6 inches to 10 inches wide was cut, showing gold. According to Mr. Cornelius, the manager, prospects from small pieces of this indicated the quartz to be payable. Subsequent tests, however, proved the gold to be confined to a very small pocket, and the surrounding quartz to be unpayable. This spot appears to be the south point of the shoot of quartz called at the surface the Sebastopol reef, and the occurrence of gold at this end of it must be considered an encouraging feature, as at the surface and in the workings from the Sebastopol shaft, the payable shoot of gold occurred in the northern portion of the mass, the southern part being practically barren.

As the attached plan shows, the channel of the Black reef does not conform to the bedding of the country, but cuts across it at an angle of about 40 deg. Along several of the bedding planes passed through in the level on the Black reef, a small amount of movement has taken place, causing the formation of thin pug seams and quartz on polished walls. Along two of the firmest of these walls drives have been put in northward from the level on the Black reef. The first (No. 1 on plan), which is 150 feet from the main cross-cut is in 50 feet from the level, and forms approximately the S.E. limit of the supposed Sebastopol shoot of stone. The second (No. 2 on plan) is at 220 feet from the main cross-cut, and, so far as it has been driven (25 feet) forms the western boundary of the shoot. The only work being done in the mine is on the first mentioned wall, which in the present face carries from 1 inch (in the back) to 4 inches (on the floor) of mineralized quartz. The distance between the two faces is 52 feet, so that in reaching the northern portion of the shoot that amount of driving would be saved by abandoning the present working face and extending the drive marked No. 2 on plan, in which there is a full face of lode matter.

[*Report sent in 11.11.09.*]

I beg to report that to-day I inspected the work done in the Lady Nelson mine, since 13th November, 1909. The drive at 150 feet N. of the cross-cut at the No. 8 level has been extended 20 feet. The footwall of the reef channel continues well defined, but the western wall is somewhat irregular. The lode matter between the walls has widened to 2 ft. 6 in. in the back and 2 feet in the floor, and carries an increased amount of mineral. A little water is oozing from the face, and the appearance of the ground exposed by the last firing out is a distinct improvement on any other portion of the reef opened up.

[*Report sent in 22.11.09.*]

THE PRINCE OF WALES MINE, WEHLA.

By A. M. Howitt.

The Prince of Wales mine is situated in the township of Wehla, on Jericho Creek, parish of Wehla, midway between the railway townships of Wedderburn and Bealiba. (Plate XXI.)

The present lease is No. 5447 (area 26a. or. 10p.), which takes in the old workings of the Prince of Wales and Adelaide shoots, besides a smaller reef to the east known as the Scotchman's line.

The Prince of Wales reef was first worked about the year 1860, so I am informed; at that time claims were limited to a frontage of 24 feet, but very rich yields were obtained and the reef was mined for a great width, as is now evidenced by the subsided and open chasm along the line. In 1865, Mr. Nicholls was manager of the mine, and did a large amount of work at the levels above 150 feet on ore which is said to have paid dividends. One leader is stated to have been very rich, yielding coarse nuggety gold, one stone giving 80 oz. of gold.

Subsequently Mr. Cato deepened the main shaft, which had been sunk to 150 feet by Mr. Nicholls, and carried it down to a depth of 300 feet, the water being managed with a 6-in. lift. The country rock is strata of Ordovician age, and exhibits a certain amount of metamorphism due to the adjacent granodiorite which outcrops about half-a-mile away. On account of this contact-alteration a variety of rocks is seen, such as slates, schists, and indurated sandstones of varying colour, with an occasional bed of quartzite. These rocks are penetrated along certain fault lines by dykes formed of a rock which is probably lamprophyre.

The reef channel strikes N. 10 deg. W. and dips 77 deg. W., and is formed along a fault fissure which can be distinctly seen cutting a synclinal fold (see transverse section). This channel is occupied by a large quartz reef with spurs dropping from the footwall, the whole formation occupying a great width and pitching north at an angle of 15 deg. The low angle of pitch allowed of the working of the formation for a length of 400 feet near the surface. the chasm along it, including the subsided portions on the north end, being 506 feet in length.

The correct length of the shoot or payable portion of the formation, taken at right angles to the line of pitch, is over 100 feet; and on the pitch the quartz reef and spurs have been stoped out from just below the 200 feet level up to the surface.

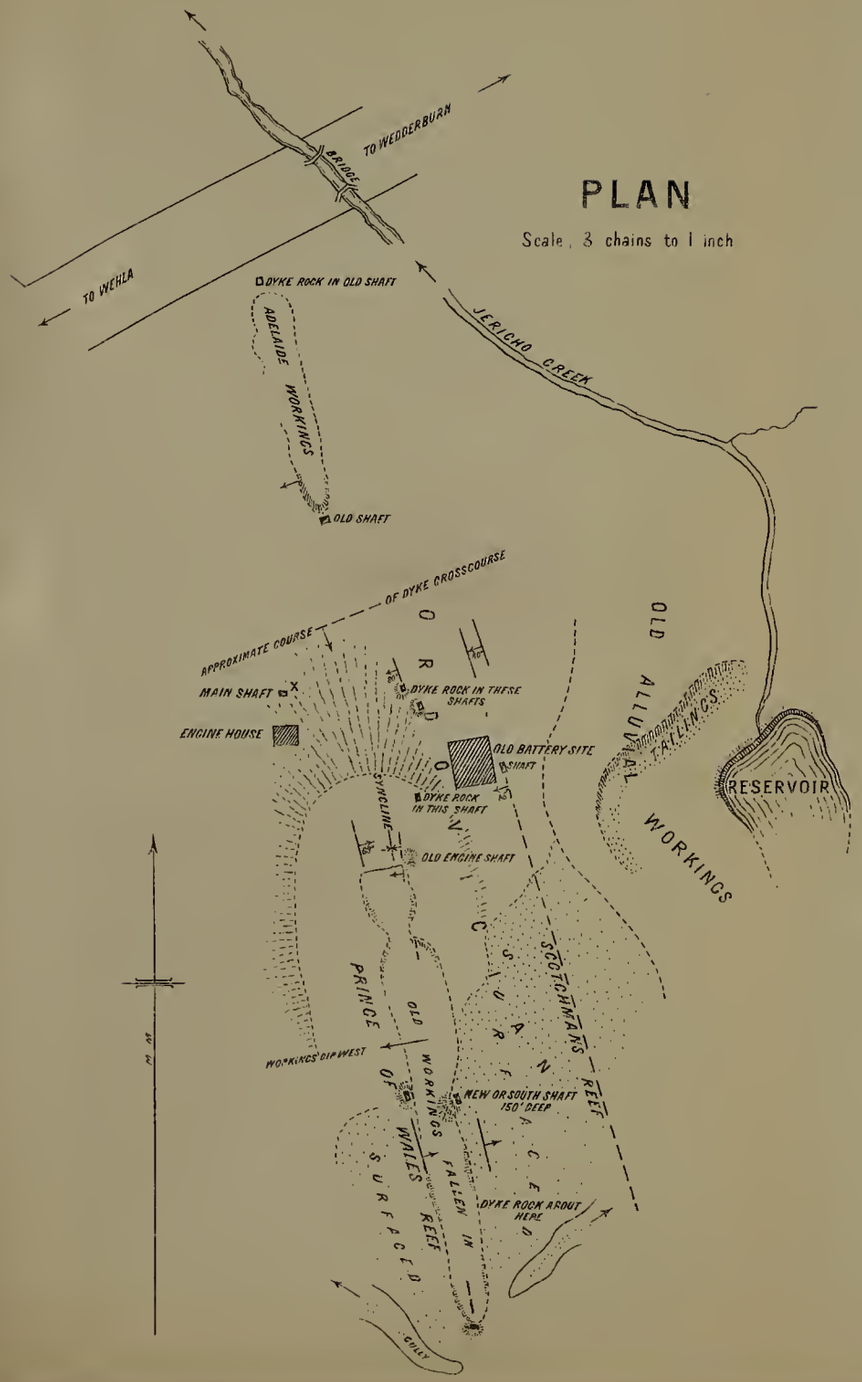
The formation was richest where the footwall spurs were prevalent; the nuggety gold was found in these spurs, which cut "indicator" slates with laminated bedded quartz veins.

The reef at the Prince of Wales mine appears to have been formed by the infilling of a fault, which trends about N. 10 deg. W., with large massive quartz reefs. Subsequently the main fissure was displaced by a series of small faults trending in an easterly and westerly direction, and molten rock was then injected into the main and subsidiary fissures in the form of a lamprophyre dyke. In some of the cross faults the dyke cuts across the main reef, thus proving that the lamprophyre is younger in age than the quartz. A similar, but still clearer case, is described on p. 137.

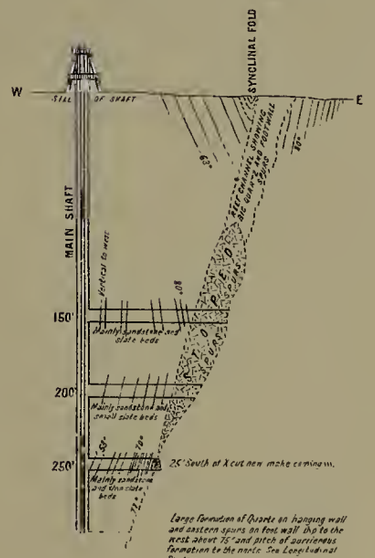
The intrusion of the dyke would cause a certain amount of small displacements and fissures, which would account for some of the small spurs of quartz or cross leaders being formed between the main dyke on the east and the big reef on the west.

PRINCE OF WALES GOLD MINE
WEHLA

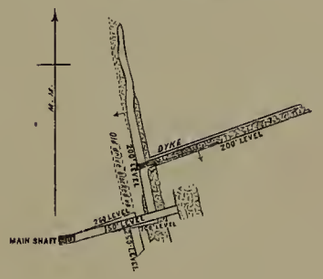
PLAN
Scale, 3 chains to 1 inch



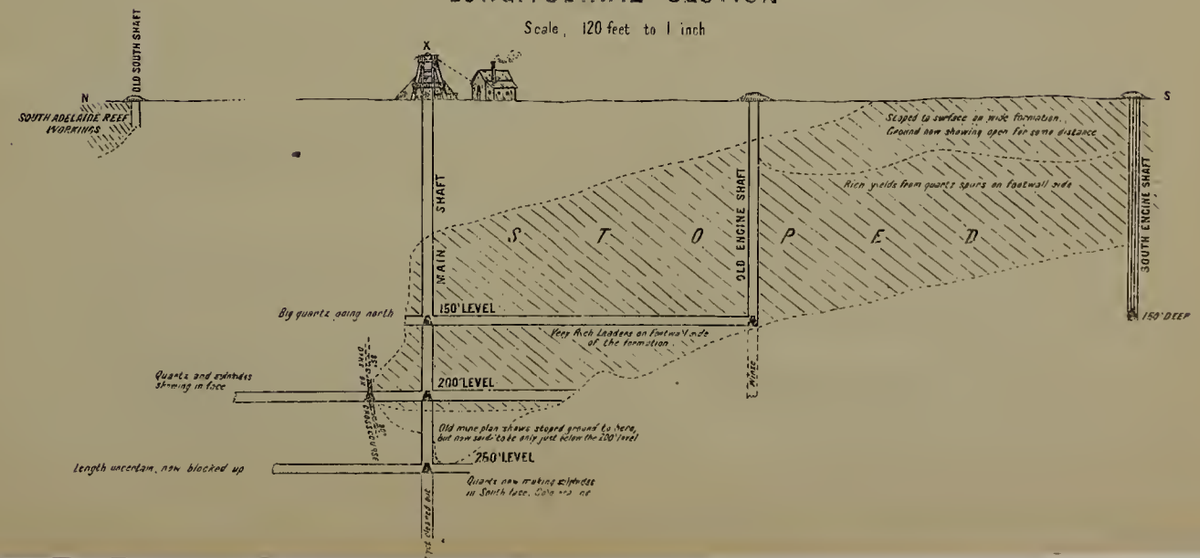
TRANSVERSE SECTION
Scale, 120 feet to 1 inch


W
E
SILL OF SHAFT
SYNCLINAL FOLD
MAIN SHAFT
150'
200'
250'
Mainly sandstone and slate beds
Mainly sandstone and small slate beds
Mainly sandstone and slate beds
25' South of X cut new make coming in.
Large formation of Quartz on hanging wall and eastern spurs on foot wall dip to the west about 75° and pitch of auriferous formation to the north. See Longitudinal Section

PLAN OF UNDERGROUND WORKINGS
MAIN SHAFT
Scale, 120 feet to 1 inch



LONGITUDINAL SECTION
Scale, 120 feet to 1 inch


N
S
X
OLD SOUTH SHAFT
SOUTH ADELAIDE REEF WORKINGS
MAIN SHAFT
OLD ENGINE SHAFT
SOUTH ENGINE SHAFT
150' DEEP
Slopes to surface on wide formation. Ground now showing open for some distance
Rich yields from quartz spurs on footwall side
S T O P E D
150' LEVEL
Big quartz going north
Very Rich Leaders on footwall side of the formation
Quartz and schistose showing in face
200' LEVEL
Old mine plan shows stoped ground to here, but now safe to be only just below the 200' level
250' LEVEL
Length uncertain, now blocked up
Quartz now making schistose in South face. Cube not ce

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NATURAL HISTORY

These small fissures or footwall leaders are best developed where the reef channel cuts through slates, so the folds and their pitch are of importance as guides to the position of other slate beds on the reef channel.

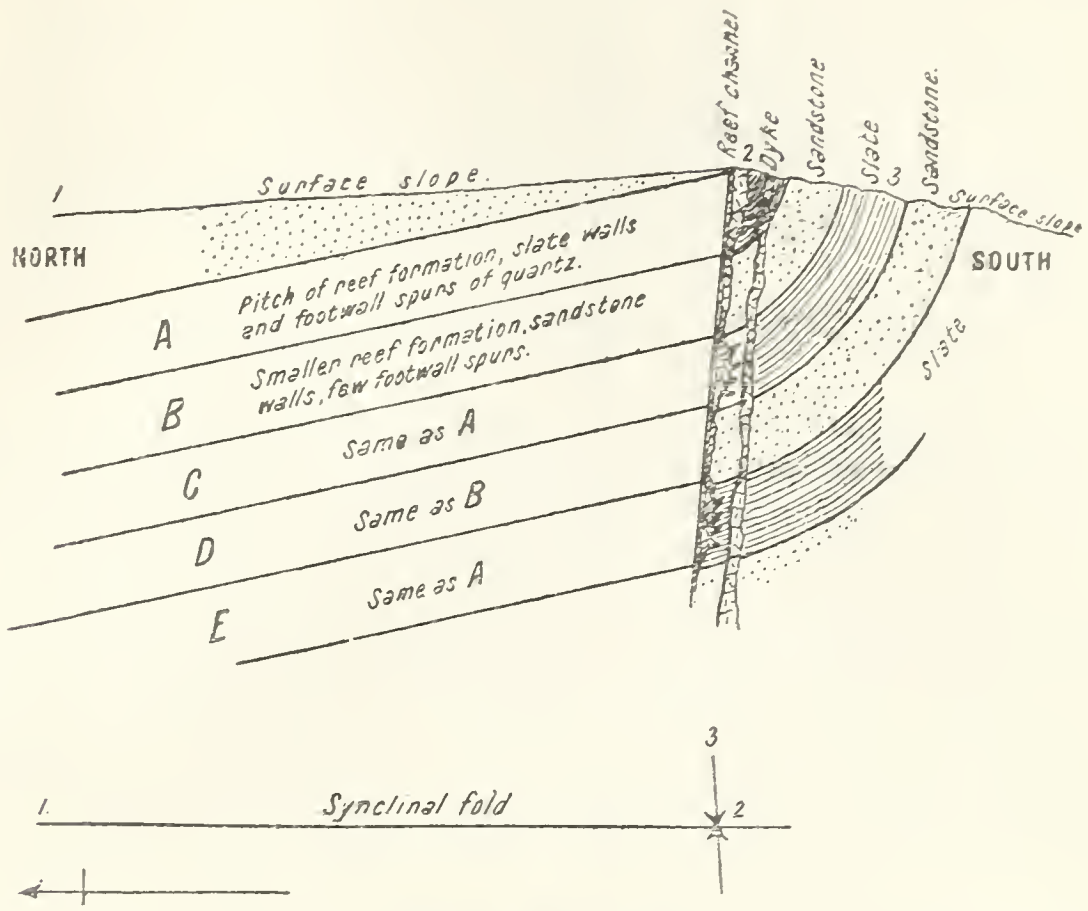


FIGURE NO. 18.

DIAGRAMMATIC SECTION. NOT TO SCALE.

The old workings of the sixties are now somewhat inaccessible, the deeper workings having been carried on from the old engine shaft at the north end of the chasm and the main engine shaft, 8 feet by 4 feet, in which the present company are working. The old shaft is stated to be 150 feet deep, with a winze at that level for a further 45 feet. From this old shaft very rich ground was mined, and it was with the view of following certain rich veins dipping north that the main engine and pumping shaft was sunk.

This main shaft was sunk by Messrs. Cato and Nicholls to 300 feet, with cross-cuts at the 150-ft., 200-ft., 250-ft., and 300-ft. levels. The old stopes at the 150-ft. and 200-ft. levels show that the reef formation was mined for a width of 25 feet in places, narrowing to a few feet below the 200-ft. level. The present company are working from the main engine shaft (or Cato's), and are driving at the 200-ft. level, and are in about 130 feet, or 90 feet north of the cross-course, which is filled with dyke rocks, and past which no stoping has been done on the Prince of Wales shoot. Their north face at the 200-ft. level shows the footwall side of the reef formation, exposing 4 inches of slate, quartz, and pyrites, followed by 2 ft. 6 in. of quartz which is somewhat spurry, and is associated with arsenical and iron pyrites. Several feet of the reef channel remains to be cut before the hanging wall is reached. In driving at this level the prospects have been poor.

At the 250-ft. level they are driving south; the quartz has widened from a few inches, where cut in the cross-cut, to 4 feet of spurs and mineralized laminated quartz on the hanging wall at a point 25 feet south, at the time of my inspection. Here the south face showed 2 feet

of laminated quartz on the hanging wall, with 2 feet of spurs to the east, both accompanied by arsenical and iron pyrites, and carrying prospects of gold. One piece of quartz from the hanging wall showed a coarse colour of gold in the solid stone. This quartz formation appears to be the beginning of a new reef coming in from the south and going underfoot.

The company have not yet cleaned out the shaft to the 300-ft. level, where report states that gold-bearing stone was cut and a shallow winze started; but it is their intention to do this as soon as possible, to enlarge the shaft and sink further, which is the policy needed for the development of this reef.

In the meantime driving is being continued south at the 250-ft. level on the 4-ft. reef.

The past yields are said to have aggregated 60,000 oz. of gold from the Prince of Wales, including quartz yielding from 90 oz. down to 5 dwt. per ton. Some fairly large crushings of 12 oz. and 20 oz. are said to have come from the rich leaders north of the old shaft at the north end of the chasm. Apart from the reported rich yields, there are the workings to demonstrate that the Prince of Wales was a very good reef and of great width in places, keeping, it is said, three crushing plants busy at the one time. The immense heaps of battery-sand, which have been so profitably cyanided in recent years, also show that much gold was lost, besides the loss of the pyrites, &c., which is plentiful along the formation.

About 150 feet to the east of the synclinal fold a series of slates can be seen at the surface close to the Scotchman's reef line, and these slates should, if not faulted, fold under on the syncline and be cut by the main reef channel at a depth of about 400 feet or thereabouts, where a wide reef formation with spurs may again occur similar in structure to the main formation already worked.

Box, red ironbark, &c., suitable for mine timber, are plentiful and near at hand. The company has a plant consisting of a double steam winding winch, multitubular boiler, tanks, cages, &c. It may be added that the company have another engine shaft midway along and to the east of the chasm, but after sinking it 156 feet deep and cross-cutting 44 feet they abandoned it and erected the plant at Cato's main engine shaft.

In the lease, and to the east of the Prince of Wales reef, there is a small spurry reef known as the Scotchman's line, which dips to the west and strikes N. 18 deg. W., so it will soon unite with the Prince of Wales line to the north of the Adelaide shoot. Only a little work has been done on the Scotchman's line, and that to a depth of about 35 feet in places, where stone worth 8 dwt. of gold per ton was found in small and short shoots.

To the north of the Prince of Wales, and in the present company's lease, are the workings on the Adelaide shoot. In structure it is similar to the Prince of Wales, except that its footwall spurs are more vertical. Here very rich quartz was mined to a depth of 120 feet from the surface, and for a great width; the chasm at the surface is evidence of the amount of work done. The deepest shaft is said to be 160 feet deep, and the shoot pitches north, as in the Prince of Wales. At the north end of the Adelaide there is a cross-course filled with a rock which appears to be lamprophyre.

Mr. J. Wilson, the manager, rendered me every assistance during my examination.

[*Report sent in* 29.7.09.]

THE GOLDEN GATE MINE, WEHLA.

By A. M. Howitt.

The mine is situated one mile and a half south of the township of Wehla, on the Wehla-Bealiba road. The area is held under lease 5529 (47a. or. 10p.), and embraces the workings known as the Little Nell and Bismarck, which are both situated on the same line of reef. (Plate XXII.)

The surrounding rocks are green and yellow slates and sandstones less altered than those to the north and east of the township since they are further away from the large mass of intrusive granodiorite near Wehla. The beds are penetrated by a main line of fault; following this southwards, it is found to be cut across at intervals by later faults which throw its continuation to the east, a feature very pronounced in the vicinity of the mine. A lamprophyre dyke of still later date fills this main fault and the secondary faults that displace it, and in consequence follows the very remarkable zig-zag line of outcrop shown on the plan.

The main dyke is closely associated with the main auriferous shoots at Wehla, where the gold-bearing reefs were wide spurry quartz formations in a series of slate beds and accompanied by the dyke. This dyke can be traced at intervals along the workings of the Prince of Wales, Frenchman's, Petticoat, and Black reef shoots which are all on the main line which has been faulted to the east, going south, as stated above. In the northern portion of the Golden Gate Lease, the south workings on the Black reef can be seen with the dyke directly on the east side or footwall of the reef, which has been mined for a fair width. South of this point the Black reef is lost; the reason is that the strike of the reef and the dyke across the strata carries them out of the favorable slates and into a barren series of beds where sandstones predominate. Twelve chains south of the point where it enters the sandstone series, the main dyke sends off a western branch along a cross-fault which runs up the hill and abuts on a large quartz blow and the main intrusion of dyke itself only goes 4 chains further up the hill and then turns north-east along another fault which it follows for 6 chains to a large quartz reef. Along this reef it remains on the footwall or east side for $8\frac{1}{2}$ chains, again meeting a fault line it follows back north-east right to the Little Nell-Bismarck line of reef. Along this zig-zag course it cuts across some of the large quartz reefs, thus showing that the igneous matter was intruded after the first big reefs were formed and faulted.

The main old reef lines were formed in fault fissures running more or less north and south. These main faults were themselves displaced by small cross faults which moved the country rock and reefs to the east going south. Subsequent to the formation of these two sets of faults the molten rock was intruded as dykes and naturally found its way along these fractures. The cross faults are more complicated and close together in the Golden Gate area than between the Prince of Wales and Black Reef Mines, and hence the difficulty in definitely saying what line the Golden Gate (Little Nell-Bismarck reef) is on. The reef is, however, associated directly with the lamprophyre dyke which runs south from the Prince of Wales and Black reefs, and which, by repeated cross-faulting, has been guided back into the series of folded slates in which the main Wehla line of reefs occurs; this has an important bearing on the Golden Gate and country to the south of it.

The main gold-bearing belt at Wehla is somewhat narrow and is confined to a line of folded beds well exposed, for instance, at the Prince of Wales Mine. Owing to the pitch, various slates and sandstones come to

the surface along the strike of these folds, and it is in the slates that the main reef formations have been mined; they are most spurry when accompanied by the main line of dyke.

The Golden Gate reef channel (Little Nell and Bismarck) strikes N. 10 deg. W. and dips 80 deg. W., cutting across slates which dip 70 deg. E.; it is formed along a fault fissure. The formation consists of a quartz reef with quartz spurs on the footwall, the whole being from 2 feet to 4 feet in width. The channel at present traverses favorable slates mainly of a green colour. The quartz is often of a vitreous and laminated character and carries patches of iron pyrites both fresh and oxidized.

The north workings are known as the Bismarck and the south as the Little Nell.

The Bismarck Workings.

The Bismarck portion of the line is now being mined by a tribute party whose deepest workings are at 84 feet from the surface in the Bismarck main shaft, where there is a drive 25 feet or so in length with stopes behind south and above. There are several shafts, mostly on the underlay. Taking an average it may be said that the stopings are 90 feet long by 60 to 84 feet deep in places at the present time. Besides this there is a small amount of stoping done around the North Bismarck shaft. The stoped ground as yet does not give sufficient data to determine the pitch of the Bismarck shoot, but further development of the mine should soon settle that point. Although the Bismarck workings are north of the cross fault and dyke there are patches of felspar nearly 200 feet away from any dyke rock, showing the far-reaching influence of the dykes when in contact with a line of reef.

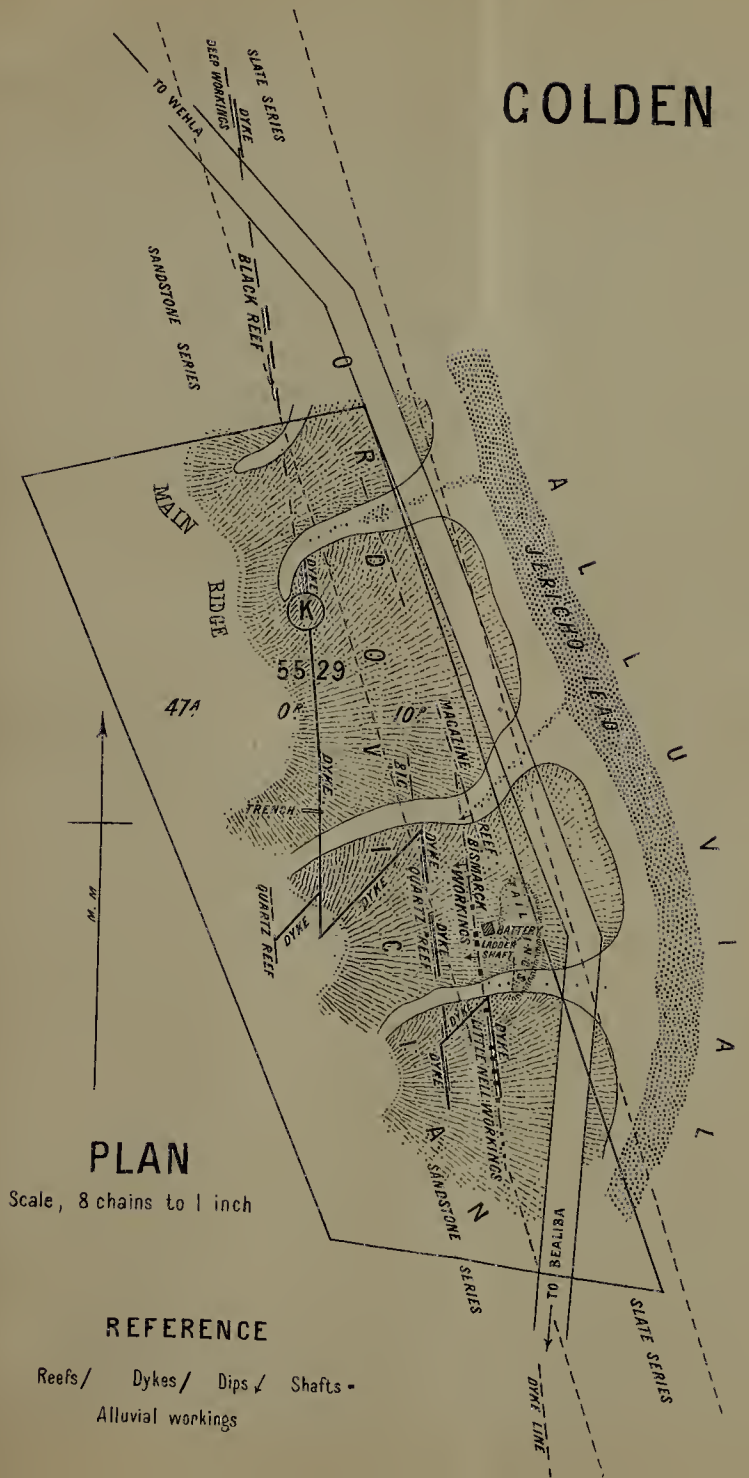
The Little Nell Workings.

Southwards and across the gully are the workings of the Little Nell, which are at present inaccessible but are shortly to be examined by the company. I made a careful surface examination of these workings in company with Mr. Clements, the manager, who informed me that the deepest shaft is sunk 90 feet and the stopings are reported to extend from a depth of 80 feet to the surface on a reef formation from 6 inches to 4 feet wide and from nearly vertical to westerly in dip. By dropping the tape down some of the shafts along the stoped area I was able to find that, at least in the top of the stopes, the pitch of the shoot had been from 15 deg. to 20 deg. N. Seeing that practically throughout the Wehla field the shoots have been to the north, I consider that the pitch here and also at the Little Nell will be to the north, and especial care will be necessary in following it through the cross fault dyke as the dyke may dip south and prove misleading, as it might make the shoot appear to trend south. After the dyke comes in on the cross fault it turns and runs along the Little Nell line, showing in nearly every mullock heap. The shafts are numerous and vary, I am told, from 40 feet up to 90 feet in depth. Good specimens have been found south of the Little Nell but not much work has been done.

Magazine Reef.

In conclusion another reef in the lease may be noted; it strikes N. 18 deg. W. and dips 70 deg. W. in eastern beds. The Magazine reef will be a convenient name for it. It is a smaller reef formation, and as can be seen by its relative strike and dip, will soon junction with the main reef to the north of the Bismarck workings. A return of 6 dwt. from a small parcel of quartz is reported.

GOLDEN GATE MINE WEHLA



PLAN

Scale, 8 chains to 1 inch

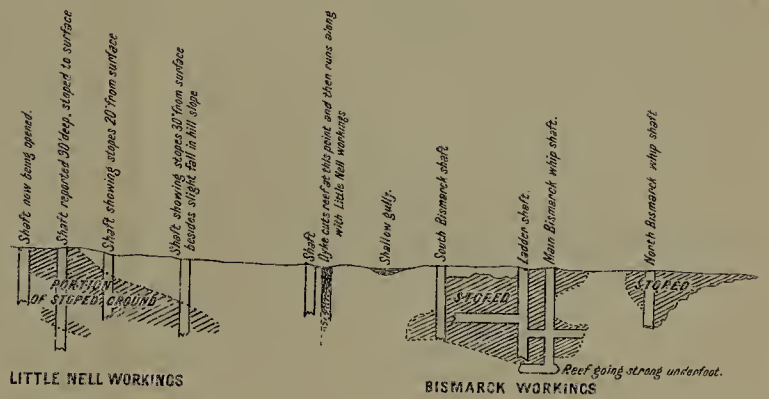
REFERENCE

Reefs / Dykes / Dips ↙ Shafts -

Alluvial workings

LONGITUDINAL SECTION

Scale, 160 feet to 1 inch.


Shaft now being opened.
Shaft reported 30 deep, stoped to surface
Shaft showing stopes 20' from surface
Shaft showing stopes 30' from surface besides slight fall in hill slope
Shaft
Dyke cuts reef at this point and then runs along with Little Nell workings
Shallow gully
South Bismarck shaft
Ladder shaft.
Main Bismarck whip shaft.
North Bismarck whip shaft.
PORTION OF STOPED GROUND
STOPED
STOPED
Reef going strong underfoot.
LITTLE NELL WORKINGS
BISMARCK WORKINGS

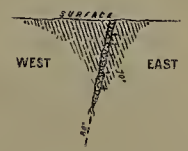
SECTION OF REEF

40 Ft LEVEL SOUTH OF LADDER SHAFT

Scale, 8 feet to 1 inch.

SECTION

Scale, 160 feet to 1 inch.



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HISTORY

Yields, &c.

Yields from the Bismarck workings near the surface are said to have been as high as 2 oz. of gold per ton, and a slug of gold 1 oz. in weight is reported from a quartz spur. But the following returns give the value of the whole formation in bulk, including big and small quartz spurs with included mullock taken 4 feet wide in places. June, 1909: 48 tons for 17 oz. 16 dwt. 10 gr. of gold. July, 1909: 73 tons for 18 oz. 7 dwt. 20 gr.

Yields of 7 oz. of gold from small parcels of stone are reported from the Little Nell; such ore is probably from a rich spur. At present information about this reef is scanty but the amount of stoping visible from the workings near the surface shows that a good payable shoot was mined in past years.

The reef may then be said to be similar in structure to the Prince of Wales, Black Reef and others along the belt, bulging or pinching according to the strata traversed, and at times subject to the influence of "indicator" slates. Sinking is necessary to exploit both the Bismarck and Little Nell which have so far only been slightly worked. The company has a 10-head battery on the mine, which is at present being kept going by the tribute party. Splendid timber for all mining uses is readily obtained.

[*Report sent in* 28.7.09.]

AURIFEROUS SLATES, GOLDSBOROUGH, NEAR DUNOLLY.

By A. M. Howitt.

Skene and party's workings are situated at Nuggety Gully, 300 yards east of Whittaker's allotment 19, parish of Painswick, about 1 mile S. of Goldsborough Railway Station. The workings are in a black slate formation of Lower Ordovician age; some narrow beds of yellow to white and grey slate are intermixed with the dark variety. The strike of the strata is N. 20 deg. W., and the dip is eastward, and ranges from 75 deg. to 80 deg. To the east of the black slate is a harder green slate which at times is seen in the south workings as a footwall to a large quartz reef.

At the source of Nuggety Gully lead, and close to the gully, some shafts were sunk without success many years ago on the black slate in search of a reef which was supposed to have shed the large nuggets in the lead. At that time no attention was directed to the possible value of the slate itself, although it gives prospects of fine gold wherever tried along the line.

About six months ago Mr. Thomas Skene obtained favorable prospects up the hill side from the gully, and subsequently sunk two shafts each to a depth of 40 feet. Although good prospects were got the gold is finely divided, and has evidently partly originated from the slate apart from the quartz veins. Skene and party are now sinking to the north on a slate and quartz-vein formation, which gives prospects of gold in the dish. A sample of black and other slate with quartz taken from the shaft was assayed; the return was only 16 grains of gold per ton (assay No. 294).

The main 40-ft. shaft is 6 chains south of this point; it exposes 6 feet of black slates with quartz veins at intervals. At 30 feet a drive has been put in for 15 feet, and at 40 feet there is a cross-cut a few feet long in the black slate. The face exposed at 40 feet in this shaft is as follows, going from west to east:—

	ft	in.
Black slate—an inch or two		—
Two nearly vertical quartz veins	0	4
Black graphitic slate	0	3
White to yellow slate	0	1½
Black graphitic slate	1	3
White to yellow slate	0	3
Siliceous track—fault parallel to the bedding ...		---
Black graphitic slate	1	2½
White to yellow slate	0	2
Black graphitic slate	1	1
Nearly vertical quartz vein	0	2
Black graphitic slate with bright red patches ...	1	8
Total ...	6	6

The whole formation is cut at intervals by quartz veins, many occurring at the 40-ft. level at the main shaft. Small faults with a throw of an inch or so occur, sometimes dipping to the east, but more commonly to the west. Three samples were taken for assay from this place with the following results:—

	Gold per ton. oz.	dwt.	gr.
Assay No. 291. Average sample of slate free from quartz	0	2	23
Assay No. 292. Average sample of slate with quartz	0	1	7
Assay No. 295. Green slate 1 foot wide directly E. of the black slate	0	0	16

The samples were broken out by myself after cleaning the face.

One and a half chains south of the main shaft there is a small shaft which exposes a big quartz reef with black slate to the west of it. Further south, about ¾ chain down the hill, there is a shallow shaft 6 feet deep, which exposes more of the black slates, and ¾ chain further on is Skene's south shaft which follows the beds on the dip, 75 deg. E. Here the formation has been proved to a depth of 40 feet and to a width of over 4 feet; it consists of green slate with a quartz reef to the east. A sample taken from the black slates and quartz veins on the heap assayed 1 dwt. 2 gr. of gold per ton (No. 293). Half a chain further south a 20-ft. shaft exposes the big quartz reef with its accompanying green slate, and ½ chain beyond this an old shaft 70 feet deep exposes much black slate, and the same formation again appears at an old shaft 80 feet deep at the source of the lead. Between this point and Skene's main shaft the distance is about 350 feet, and for this length the black slate averages about 4 feet in width.

In regard to the gold in the slates it may be stated that throughout these rocks there is much decomposed pyrites of small size, and that the gold has quite possibly been set free from this mineral. Below the water level, which should here be well over 200 feet deep, the pyrites is probably unaltered.

It is possible that the cross quartz veins may at times be rich, the formation being of the indicator class, but the value of the mine must be based on the bulk value of the black slates and small veins.

The following report has been made by Mr. Bayly on a large sample procured by Messrs. Laidlaw and Skene:—

Steatitic slate, dark coloured.

Total weight of sample received, 14 lbs.

The material was broken down and crushed to obtain a fair sample. This was analyzed, and a series of cyanide tests were made on it (No. 290).

Assay value of bulk—

	oz.	dwt.	gr.	
Gold	0	1	23	per ton.
Silver	0	0	11	per ton.

Owing to the low value of the gold no amalgamation extraction was made.

On attempting to treat with cyanide in the ordinary manner it was found that owing to the extremely fine nature of the material it became quite impervious to solution. No percolation was possible. To render the test effective the sample was then thoroughly mixed with an equal weight of coarse quartz sand free from gold, and again treated with cyanide solution. Even with this assistance the solution would not pass through the vats, and it became necessary to use a reduced pressure or suction. The experiment was then carried on as usual, with the following results:—

Stength of cyanide solution, 0.24 %.
Alkali required, 5 lbs. lime per ton.

	Time. hours.	Gold. oz.	dwt.	gr.	Cyanide Consumed.
Extractions—	24 ...	0	0	22	... 2 4 lbs. KCy.
	48 ...	0	0	17	... 1.5 ,,
	96 ...	0	0	3.7	... —
		0	1	18.7	=97 %

Assay of residues after experiment, 0 oz. 0 dwt. 4.3 gr. gold per ton.
Cyanide consumed, 3.9 lbs. per ton.

It will be seen that in 18 hours a payable extraction was obtained = 0 oz. 1 dwt. 15 gr.

An extensive test as to the best methods of treatment would be necessary before advice could be given. This test, together with the second experiment (see below), serve to show that the gold present is amenable to treatment and is recoverable by cyanide. The residues after the experiment contained only 4.3 grains of gold per ton.

A further sample was treated with cyanide and agitated by mechanical stirring for several hours. The solution was then filtered off through a vat-filter bed.

Strength of cyanide solution		0.24%
Alkali required ...	...	5 lbs. per ton.
Assay of original ore	...	0 oz. 1 dwt. 23 grs.
Assay of residues	...	0 oz. 0 dwt. 5 grs.
Gold extracted ...	...	0 oz. 1 dwt. 18 grs. = 90%
Cyanide consumed	...	3.35 lb. per ton ore.

From the above experiment it will be seen that the gold in this material can be recovered to the extent of 90 per cent. To effect this, however, special means would have to be adopted to enable the solution to percolate, or by agitation (stirring) to bring the solution into immediate contact with the ore and so dissolve the gold. All this must be taken into calculation in determining the value of the ore for treatment, as it would add materially to the cost.

The following is a complete analysis of the slate (No. 232) made under the supervision of Mr. P. G. W. Bayly.

SiO_2	55·78 %
Al_2O_3	20·84
Fe_2O_3	2·10
FeO	n.d
MgO	1·87
CaO	0·08
Na_2O	0·40
K_2O	5·15
H_2O+	4·18
H_2O-	7·26
TiO_2	0·87
CO_2	Nil
P_2O_5	trace
SO_3	0·17
Cl	0·09
C	1·59
	100·38
Less O = Cl	0·02
	100·36

Gold, 0 oz. 1 dwt. 0 gr. per ton.
Silver—trace.

[*Report sent in 20.5.09.*]

THE INDICATOR AT JONES'S CREEK, NEAR DUNOLLY.

By W. H. Ferguson.

The following particulars about the indicator formerly worked by the Jones' Creek Gold Mining Company at Jones' Creek, parish of Waanyarra, were gathered partly from my own observations and partly from information furnished by Messrs. Raven and Gourlay, who are successful indicator prospectors.

The bedrock consists of Ordovician slates striking N. 5 deg. E. to N. 10 deg. E., and dipping 75 deg. E. In the old workings at 15 feet from the surface decomposed yellowish slates and dark blue carbonaceous slates can be seen, all containing very small nodules of some dark mineral.

These rocks are near the limit of the area of metamorphism caused by the intrusive mass of granitic rocks to the north-west. Some of the slate beds (locally called "vughy") are distinguished by rectangular cavities, once no doubt occupied by crystals of iron pyrites which have since dissolved away. This rock closely resembles slates noted at Inkerman, Queen's Birthday, and Windmill Hill reefs. The miners and prospectors consider it a good sign if the dark-blue slates have a greasy feel and an irregular, glossy appearance. Both these features are evidently caused by movement in the rock.

The indicator is parallel to the country rock in dip and strike. It consists of a thin quartz vein occurring along a plane of movement in a stratum of dark-blue slate, and has a well-polished and striated foot-wall. One series of striations is almost in the direction of the dip of the rocks, but has a tendency to dip northwards, and the dip of the other series is more decidedly to the north. The indicator is from 1 to 3 inches thick, and finely laminated; in some parts consisting of as many as 50 layers of quartz to the inch. The thicker layers are white, and rather vitreous, with some blue mottlings, and the thinner layers are dark coloured, blue in places, and sugary in texture. The dark colour appears to be due to the inclusion of comminuted slate. It may be mentioned that during the progress of the survey of the Dunolly district thin layers of quartz were generally found to vary in colour with the containing rock, being, as a rule, white in light-coloured sandstones, &c., and dark-blue or blue and white in the dark-blue slates. It appears that the indicator has been formed by solutions flowing along the fissure and permeating the slate walls and there depositing quartz. There is no gold in the indicator.

A small quartz vein a few inches thick has been faulted by the indicator as shown in the diagram. Where it can be seen in a very small cross-cut it dips N. 10 deg. W. at 70 deg. The two dissevered ends of this quartz vein were richly auriferous where they adjoined the indicator. The contact of the vein and the indicator pitches N. at 30 deg. in one place, and at others probably at a smaller angle. The gold is very limited in its occurrence, and quartz only a few inches away from the indicator is left untouched. It has been worked along the pitch of the intersection for about 300 feet to a depth of 80 feet from the surface, where water level was reached. Pumping machinery was then erected, but was not powerful enough to cope with the water, and the mine is now idle. The stone was payable along the whole distance worked; 10 oz. per ton was obtained, and in one instance 60 oz. of gold was yielded by one bucketful of ore. Afterwards quartz taken at some distance from the indicator gave 4 dwt. and 18 dwt. per ton.

It appears that the slate bed containing the indicator offered less resistance than the surrounding rocks to pressure acting on them, and that in consequence it was fractured parallel to the bedding. The fracture became the channel through which a solution percolated, and this, where it came in contact with the solution which deposited the quartz vein in which the gold was found, led to chemical reaction which caused the deposition of gold.

[*Report sent in 16.12.07.*]

WHITE AND DE SANTI'S INDICATOR, WAANYARRA, NEAR TARNAGULLA.

By A. M. Howitt.

White and De Santi's workings are on Crown lands about $6\frac{1}{2}$ miles south-west of Tarnagulla, a little to the south-west of the Waanyarra Post-office, and 12 chains south of Calder's reef. (Fig. 19.)

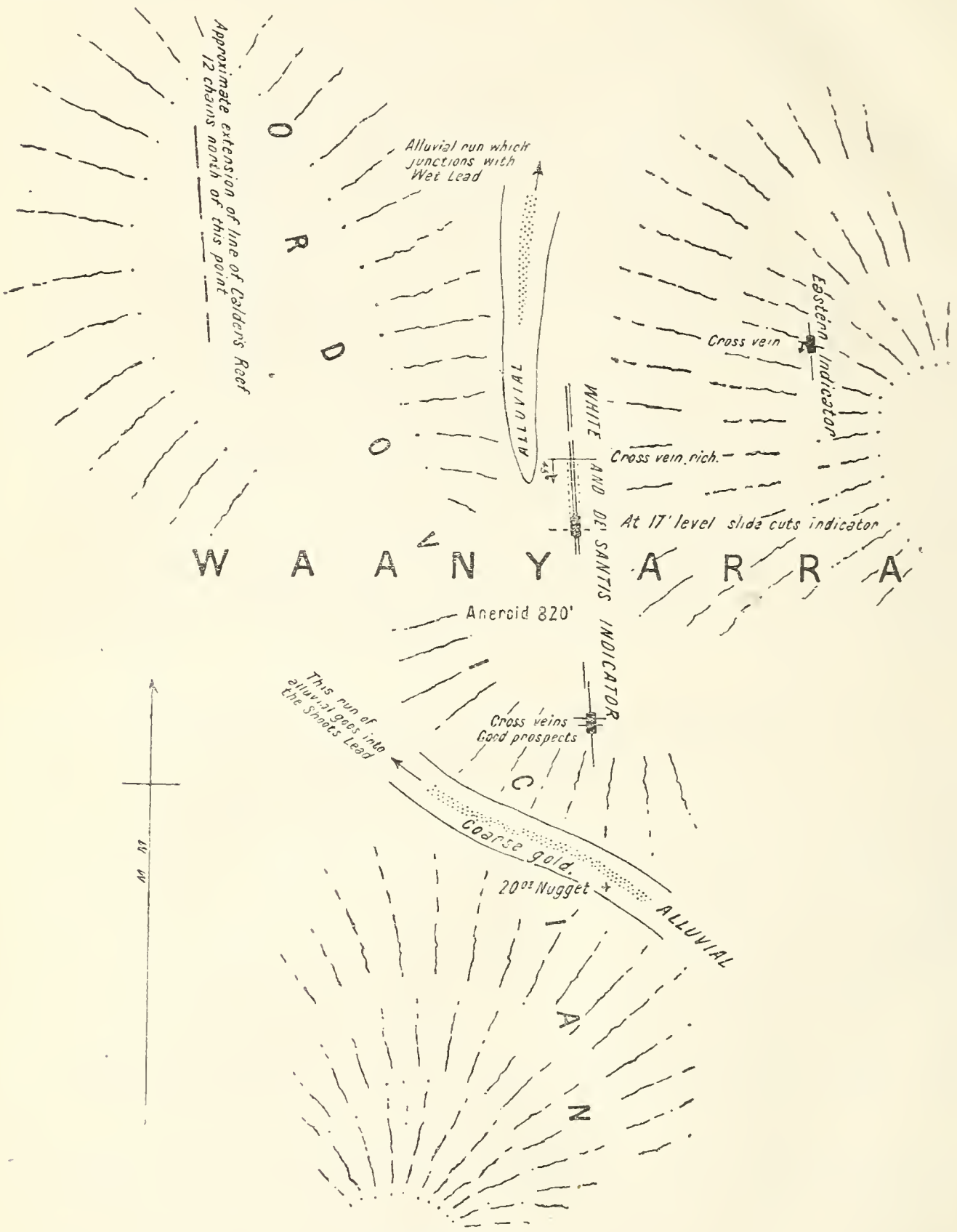


FIGURE No 19.

SKETCH PLAN OF WHITE AND DE SANTI'S INDICATOR, JONES'S CREEK, WAANYARRA.

SCALE 60 FT. TO 1 INCH.

The adjacent formations are of Ordovician age, and consist of thick-bedded sandstones and thin-bedded slates, the former greatly predominating. The best section seen is the southern face in the shaft, where the indicator is a 4-in. bed of green pitted slate with a laminated

metasomatic quartz vein directly on its western bedding plane. To the east of this slate there follows 8 inches of sandstone, and then a second bed of green slate with a ferruginous track on a bedding plane, the other beds being grey, medium-grained, sandstones. (Fig. 20.)

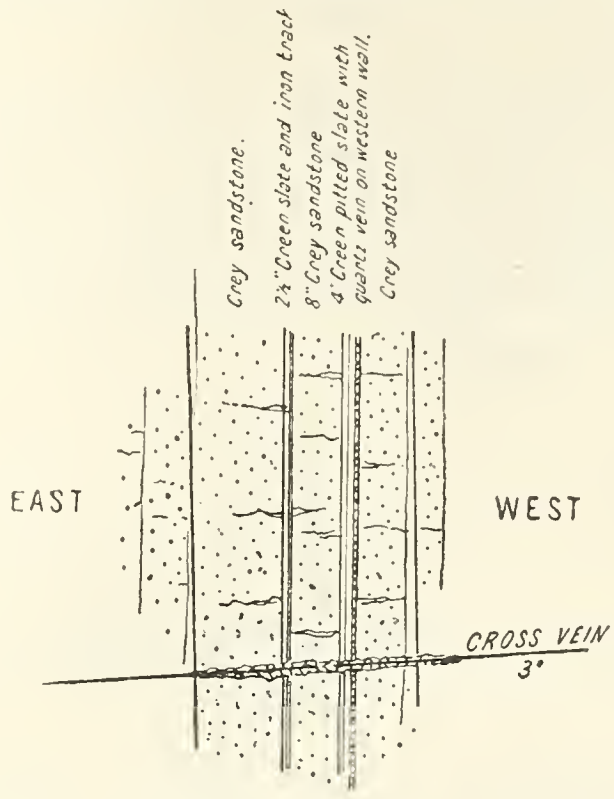


FIGURE NO. 20.

SKETCH SECTION SHOWING INDICATOR AND CROSS VEIN. SCALE 5 FT. TO 1 INCH.

The sandstone shows numerous thin horizontal quartz veins faulted at the slates and continuing on through the next sandstone beds, but only in the one case has a cross vein cut the slate, and where this occurred the gold was found on the indicator. This vein is formed by quartz and ironstone; it is from $\frac{1}{10}$ inch up to $\frac{1}{4}$ inch in thickness, and carries gold for a width of 6 inches up to 1 foot near the surface. The total yield of gold up to the slide, which cut everything off, was 5 oz. 4 dwt. 12 grs., including one specimen of 3 dwt. The cross vein has been followed for about 20 feet on the angle (45 deg. S.), and is exposed by an open cut to the surface. (Fig. 21.)

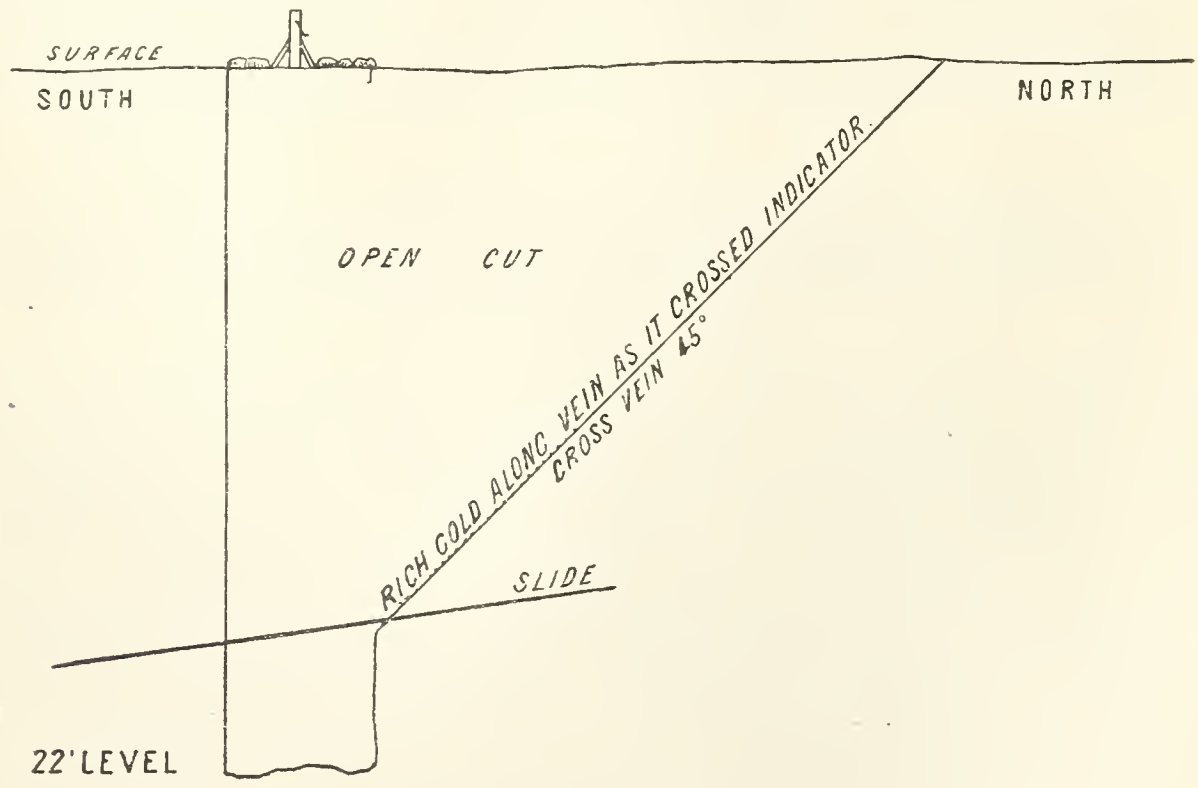


FIGURE NO. 21.

SKETCH LONGITUDINAL SECTION. SCALE 10 FT. TO 1 INCH.

In the south end a shaft follows through the slide to a depth of 22 feet, and an irregular cross-cut has been put out for 14 feet to the east on the slide.

At a depth of 17 feet, the slides come in from the west to the east, the top one at an angle of 25 deg. and the lower at 30 deg., from the horizontal. Where the slides cut the indicator there was only $2\frac{1}{2}$ inches of crushed broken rock between them, but at 12 feet in from the shaft there was over 2 feet between the slides, and the rock was more defined and becoming settled, showing that the two slides are diverging rapidly as they go east. Each slide shows a thin pug seam, and can be easily distinguished in section. (Fig. 22.)

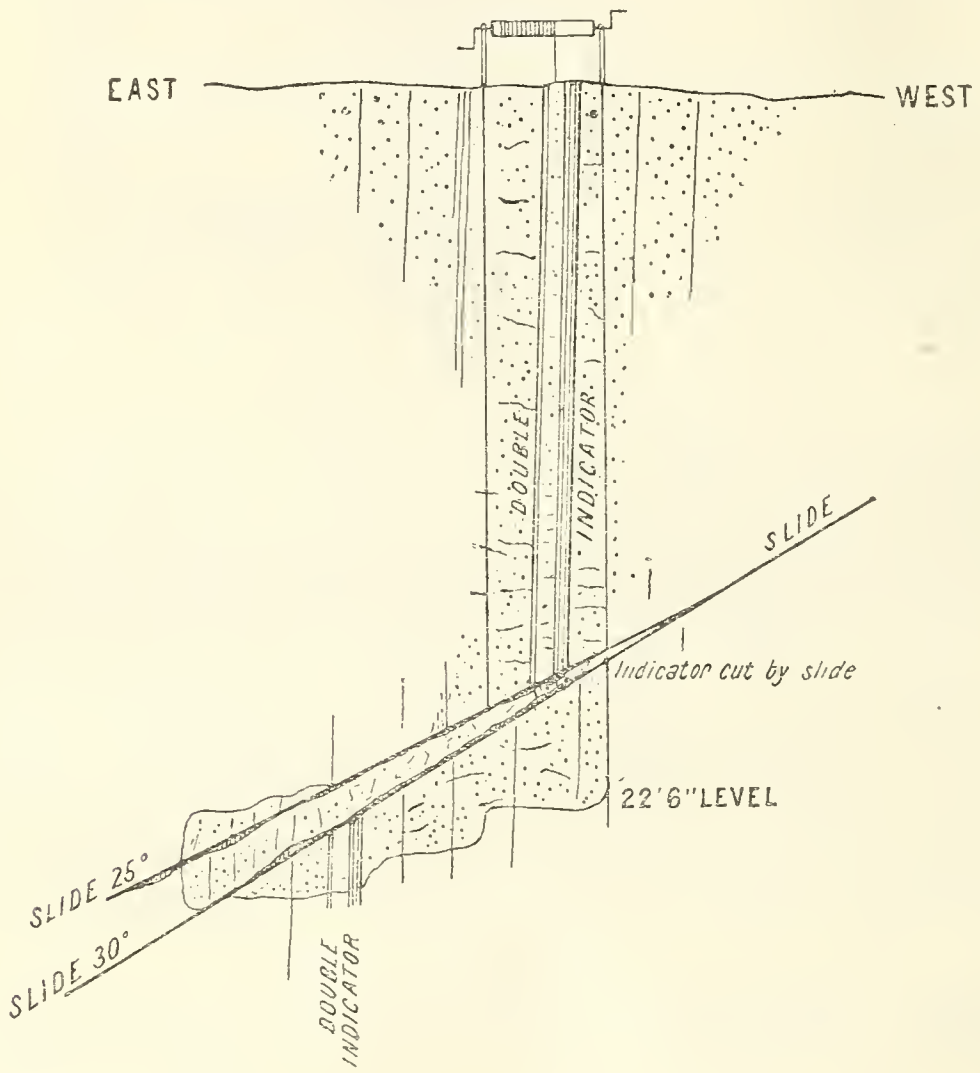


FIGURE NO. 22.

SKETCH TRANSVERSE SECTION, SHOWING SLIDES AND INDICATOR. LOOKING SOUTH. SCALE 10 FT. TO 1 INCH.

At a point 7 feet in east from the outside edge of the shaft and under the lower slide, there is a double slate indicator exactly similar to the one cut off above the slides, having the thickness of slate and sandstone, together with the metasomatic quartz vein in correct position and of similar character to the one worked. There appears to be little doubt that this is the lost indicator, and it now remains to drive south on it, keeping the lower slide as a roof to the drive, so that any cross vein cut may be prospected directly under the slide on the indicator. The distance it will be necessary to drive south cannot be stated, as it is impossible to estimate the extent of the movement in that direction, but if the cross vein has passed on under the slide it should not be very far to the south.

South of the main workings the party have sunk an 8-ft. shaft on the same line, exposing two cross veins dipping south at an angle of 80 deg.; both show very encouraging prospects. At a depth of 22 feet or so the slides will cut these cross veins and indicators, moving them also to the east.

About 1 chain up the hill to the east there is another set of indicators on which a cross vein gave good prospects of coarse gold, which cut out in a few feet. In regard to these eastern lines of indicator, it may be pointed out that the main big slides would not cut them off until a depth of 50 feet has been reached, which is in their favour.

[*Report sent in 9.10.08.*]

THE LANDSBOROUGH AURIFEROUS LEADS, EAST OF STAWELL.

By E. J. Dunn, F.G.S., Director, Geological Survey.

In this district there are three distinct systems of auriferous alluvial leads.

1st. The oldest is probably of Pliocene age. It starts near the Malakoff Gap, 7 miles south of Landsborough, and runs in a northerly direction, keeping on the western side of the valley for about 6 miles. The lead has been broken into a series of outliers by gullies that run in an easterly direction from the north and south main range. The height of this lead above the valley is about 150 feet, and it has been worked for gold throughout. Heavy quartz boulders and pebbles but partly rounded form the feature of the washdirt.

2nd. The White Lead is possibly of Post-Pliocene age. It runs nearly parallel to the old lead, but is further to the east. White quartz washdirt on a pipeclay bottom is characteristic of this lead. At any rate, part of the gold in this lead has been derived from the older lead, which is at a higher level.

3rd. The Recent leads consist of brown gravel, and their feeders intersect the old lead. Sandstone and slate form a considerable proportion of the washdirt in them. The principal Recent lead is again to the eastward of the White lead, and at a lower level. Gold from both of the older leads has been transported to the Recent leads. There are numerous gullies with washdirt of this age crossing the old lead, and these have contributed the gold to the main lead and to the patches of this age.

It appears as though most of the gold of the three classes of washdirt has been derived from the ridge running in an east and west direction, the lowest point of which forms Malakoff Gap, and, of course, from country at a higher level than the present surface. The Gap is a low notch in the east and west range that crosses the strike of the Ordovician rocks. Through it the road passes, and the cutting exposes slate and sandstone of favorable appearance, and with a strike of about N. 30 deg. W. There are two dykes exposed in this cutting. The east and west ridge forms the present watershed, and it appears to have been the watershed in Pliocene times, for the old lead trends away from it in a northerly

direction, and another contemporaneous lead, similar in character, trends away from it in a south-easterly direction. This latter contains boulders of quartz only partly rounded and measuring up to 3 feet in length. It has been worked for gold.

At present there is no abundance of large quartz reefs, such as the wash in these old leads indicates must have existed, and it is reasonable to infer that the reefs and the country rocks that held them have been removed by denudation. Outside a belt less than ½ mile wide there is not much encouragement to the westward for prospecting. Along this belt in its northward extension is the most favorable line for examination and for prospecting for auriferous reefs; there are also some belts of country further eastward that appear to have supplied gold to the leads running westward into the main lead. These also deserve attention. For prospecting operations, the winter season in this district is the best, as water is scarce in the summer months.

Up to the present, prospecting operations have been principally directed towards examining the country in the neighbourhood of Malakoff Gap. The prospectors' camp is situated about 1 mile north of the Gap, and on the main road. Eastward from the camp is a gully running westerly, and almost ¾ mile up this gully from the camp, and on the east side of it, a small reef has been opened up. It is from 4 inches to 12 inches thick; strikes N. 30 deg. W., and dips westward at 37 deg. The soil is of deep red colour, and the Ordovician slate and sandstone beds are of yellow and grey colours. A shallow shaft 12 feet deep has been sunk in the dip of the reef, and a good wall disclosed. The country has nearly the same strike as the reef, being N. 35 deg. W. and the dip is vertical. Further south other openings have been made that prove this reef for 6 chains in length. The furthest south workings are on the side of a steep gully, and here a tunnel might be driven that would give about 90 feet of backs. This reef is considered payable, but there is no battery near for crushing.

[*Report sent in 9.7.09.*]

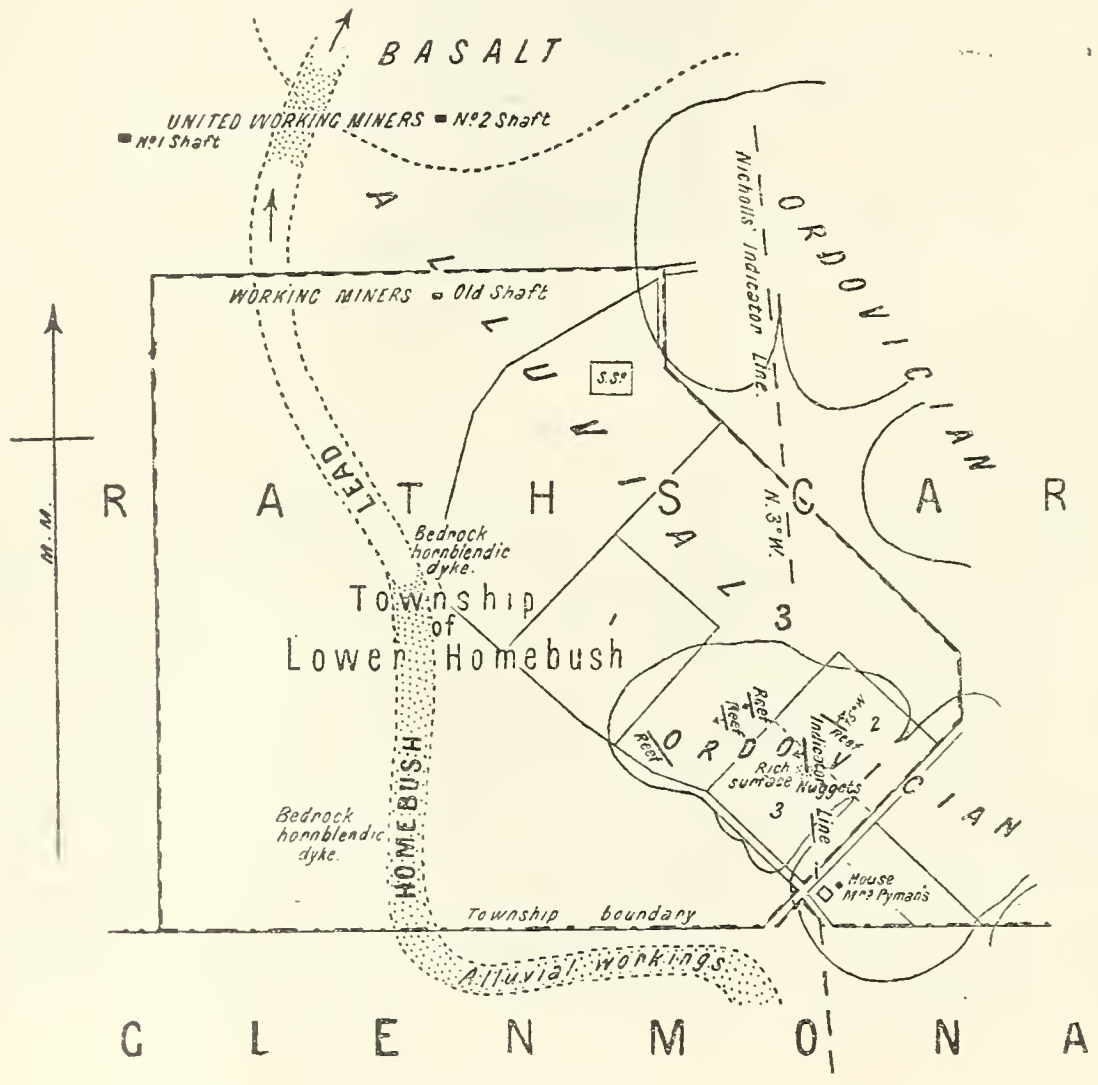
THE DREADNOUGHT CLAIM, LOWER HOMEBUSH, NEAR MARYBOROUGH.

By A. M. Howitt.

Messrs. Nicholl and Stratman's Dreadnought claim is situated in B. Pyman's allotments 2 and 3, parish of Rathscar, in the township area of Lower Homebush.

The surrounding beds are sandstones and slates of Lower Ordovician age. No fossils were obtained to determine their exact position, but graptolites characteristic of the Lancefield zone occur in Wareek, 4 miles to the west. The slates are mostly of a red and green colour, and their pitted structure is no doubt due to the adjacent igneous intrusion which occurs to the west in the bedrock of the Homebush lead; the strata strike N. 3 deg. W., and, where exposed along the indicator beds, they dip to the west at an angle of 75 deg.

The igneous rock mentioned above is green in colour and hornblendic, and probably occurs as a large intrusion along which the Homebush lead has in part taken its course near the township. Being only about 30 chains to the west of Pyman's Hill, it would probably have a favorable influence on the gold occurrences in the reefs, &c., and indicator fissures, whilst also accounting for slides, faults, and cross fissures in the strata coming within its area of disturbance. (Fig. 23.)



NOTE.— *Main boundaries and lead taken from departmental plan*

Scale, 40 chains to 1 inch.

FIGURE No. 23.

SKETCH PLAN. NICHOLLS AND STRATMAN'S INDICATOR, LOWER HOMEBUSH.

The indicator was found early in July, 1909, and is now held as a prospecting claim. The party found good prospects in the surface loams, and then uncovered the indicator and cross vein, from which 6 ozs. of gold was quickly obtained. Then followed the puddling of the surface clay around, from which over 100 oz. of coarse, nuggety gold has been won, practically in the grass roots; nuggets of 30 ozs., 11 ozs., 10 ozs., &c., have been recorded

An interesting cross section of the indicator beds is exposed at the north face of the adit at 35 feet north of the cross vein outcrop, near the 6 oz. patch. (Fig. 24.) As shown in the diagram, it exposes four small bedded

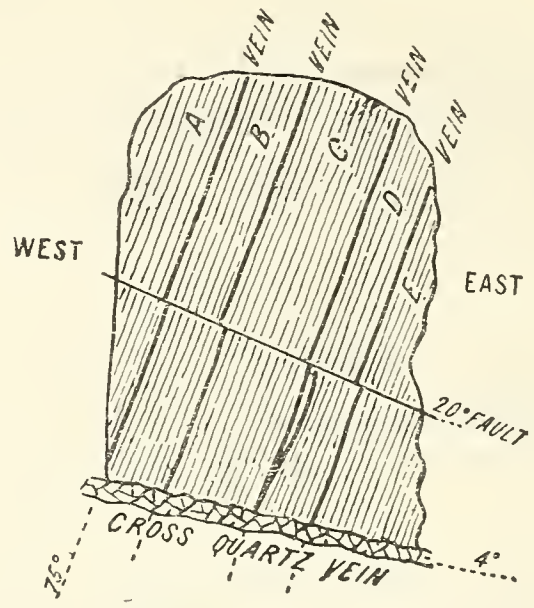


FIGURE NO. 24.

SKETCH TRANSVERSE SECTION. SCALE 4 FT. TO 1 INCH.

quartz veins associated with green slate and separated by red arenaceous pitted slates. The veins are each $\frac{1}{4}$ inch thick, and the slates marked B, C, and D in the diagram are respectively 9 inches, 1 ft. 3 in., and 6 inches thick, so that the four bedded veins occur within a space of 2 ft. 7 in. The small fault shown has moved the strata about 1 inch. The veins conform to the slates both in strike and dip. The cross vein is from 2 inches to 3 inches thick, and of the usual somewhat vitreous character. As shown in the diagram, it is not quite horizontal, but has a slight inclination to the east; it also dips to the north at an average angle of 15 deg. In viewing a longitudinal section north and south, along the indicator, there appears to be an enrichment in the cross vein where small faults and fissure lines run down on to it. (See Fig. 25.)

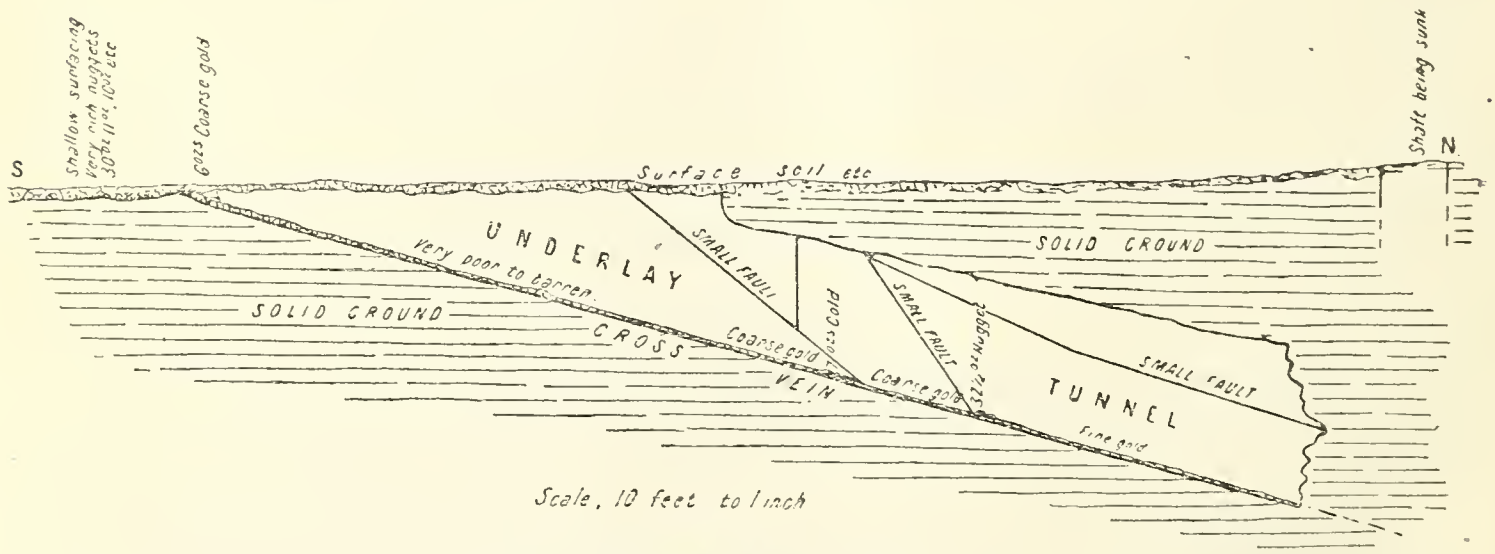


FIGURE NO. 25.

SKETCH LONGITUDINAL SECTION. SCALE 10 FT. TO 1 INCH.

The richest patch (35 ozs., including a nuggety piece of $32\frac{1}{2}$ ozs.) was found immediately north of one of these small faults. The claim-holders view them favorably. The size and richness in places of the cross vein

promise well; and its low angle of dip north is most favorable for working, as it will not reach water level for some distance. With cross veins dipping at a low angle, such as the one in question, there is every facility for prospecting for others by means of a vertical shaft on the indicator line.

At the time of inspection I was informed that 160 ozs. of gold had been won, 60 ozs. of which came from the cross vein.

The workings at present are small and consist of an underlay tunnel following the gold-bearing cross vein as it cuts the indicator beds. On this cross vein the yields have varied from fine prospects up to rich nuggety patches. as shown in the longitudinal section.

A shaft is now being sunk at a point above and a little to the north of the north face in the tunnel, and later on a shaft further north is to be sunk as the claim develops.

About 370 feet north from the tunnel mouth the indicator would pass abreast of Pyman's cross reef, a large quartz reef striking W. 30 deg. N., and dipping north-east at an angle of 40 deg. This reef is in a lease area which surrounds the prospecting claim, and from spurs of quartz in its footwall yields of 8 dwt. up to 1 oz. 18 dwt. are reported to have been won.

Just outside Pyman's allotments and close by to the north-west, two other reefs have been mined, and are here mentioned to show the frequency of gold occurrences in reefs and veins on Pyman's Hill.

Before concluding. it may be added that the strike of this Homebush reef and indicator belt would carry it southwards along with the Homebush lead which proved so consistently rich. and on towards the head of the Lamplough lead, which it would cut. Northwards the belt would pass close to and east of the last workings on the Homebush lead.

In order to see if the slate itself, apart from the quartz veins, is auriferous, a sample of red arenaceous pitted slate free from any vein-quartz was taken from amongst the several beds and submitted for assay. Mr. Bayly gave the following report (517/09):—

Red mottled with white decomposed slate from Messrs. Nicholl and Stratman's indicator claim.—

Gold, 7 dwt. 4 gr. per ton.
Silver, trace per ton.

Individual assays gave—

Gold, 3 dwt. 22 gr. per ton.
Gold, 5 dwt. 21 gr. per ton.
Gold, 7 dwt. 19 gr. per ton.
Gold, 11 dwt. 4 gr. per ton.

The sample contained much angular free gold. The small patches of clear quartz were heavily impregnated with gold.

[*Report sent in 17.8.09.*]

MARINER'S REEF, MARYBOROUGH.

By A. M. Howitt.

The lease (No. 5486) is 49 a. 2 r. 29 p. in area, and in addition to the main Mariner's reef, includes the Mariner's North, Gympie, Soldier's Hill, and Cole's lines of reef, all of which have at times been worked profitably, but to no great depth, and which are all, except the Gympie large reef formations. dipping westerly towards Mariner's line. Within the lease on Soldier's Hill there are two mining claims, Hawkes and Peel, and Hawkes and Roxburgh, to the south.

Mariner's Reef.

The Mariner's reef strikes N. 10 deg. W., and dips 85 deg. W., and occurs in the middle auriferous belt of the Ordovician slates and sandstones.

This belt shows the maximum amount of folding in the Maryborough beds, which have several synclinal and anticlinal folds adjacent to Mariner's line, and the underground structure shows that Mariner's reef cuts the strata close to a synclinal axis; the beds in the lower levels being 75 deg. east and the reef 85 deg. west in dip.

A nearly flat horizontal offshoot or lateral branch of dyke rock cuts the reef and strata, and is seen at intervals in the 523-ft. level. It has a very slight dip to the south-east, and is about 4 feet thick in places.

This flat dyke has its origin from a main vertical dyke which I found in the end of the 100-ft. western cross-cut at the bottom level. These dykes, where they intersect reefs, appear to have a very favorable bearing on the auriferous shoots occurring in the middle belt. The dyke rock has been sliced and examined by Mr. D. J. Mahony, M.Sc., F.G.S., who classes it as a minette of fairly fine grain, consisting of orthoclase felspar, black mica, and some hornblende with secondary calcite and serpentine, which probably represents original olivine. Gold has been obtained above and below this flat dyke branch and was especially rich in the Little reef shoot. Should another flat dyke branch cross the reef below the bottom level, rich stone may again be found. If the main dyke and reef keep their present dip towards one another, they will meet at a little less than 1,000 feet from the surface, and there is then a possibility of an enrichment in the reef, especially if another block makes on the Little reef channel below the 625-ft. level. An assay of the decomposed dyke (No. 632 assay) gave a trace of gold, which is interesting as the specimen was collected away from any quartz.

The Reef.—The main reef has been worked for over 1,000 feet north and south, and was apparently a very large reef formation of low grade quality underlying a very rich smaller make known as the Little reef, which lies to the north partly on top of the big stone, but in the same reef channel.

Report states that this Little reef has yielded as much as 60 oz. to the ton from No. 8 claim south, in a patch, and authentic records taken from the *Maryborough Advertiser* show yields from $3\frac{1}{4}$ oz. up to 8 oz. to the ton from stone 2 feet wide in places.

This rich Little reef pitched north at 45 deg., or 1 in 1, and dipped 85 deg. W., cutting beds dipping 75 deg. E. Its average width is reported as over 1 foot and up to 2 feet and 4 feet in places, and it consisted of laminated blue-white quartz, very heavy and carrying iron pyrites and galena.

Workings.—The main shaft, which has just been repaired, was sunk to a depth of 632 feet to the bottom of the well. At 60 feet cross-cuts east and west have been put in, but are now filled up and inaccessible. In the western cross-cut the manager, Mr. Williams, informed me that he noted two reef makes and all the beds dipping to the east.

At 346 feet a cross-cut was put out east for 158 feet, exposing reef tracks at 28 feet, 59 feet, and 138 feet. A slide or fault was passed through just in from the shaft, and hading 60 deg. E. The beds dip 75 deg. W. right out to the end of the cross-cut, where an anticlinal fold changes the dip to the east.

At 401 feet, 426 feet, 452 feet, and 477 feet short cross-cuts have been driven into the reef, which is only a few feet to the east of the shaft.

At 523 feet the reef was in the shaft, and drives have been extended 149 feet north and 247 feet south, exposing the flat dyke as already mentioned and the main reef track in the north face, where Mr. Williams, the present manager, reports 10-dwt. prospects from a few inches of stone, apparently the end of the Little reef make. In this level, just south of the stopes, there is quartz 2 feet wide, from which Mr. Williams obtained prospects which he considers equal to 7 dwt. per ton. At the south end of this drive there is a rise stated to be 90 feet up, but at present it is inaccessible. Several small cross-cuts have been put in from the south drive.

The most important workings, and those bearing most on the future development of the mine, are seen at the 625-ft. level, where drives extend 272 feet north and 75 feet south, with cross-cuts of 100 feet west from the shaft, and 20 feet west from the end of the north bottom level drive. The prospects of this bottom level may be stated as follow :—

The south drive (75 feet) exposes a strong quartz reef averaging 8 feet in width and showing veins of iron pyrites, &c., on the hanging wall side of the reef. Crushings from this big reef gave 3 dwt. per ton, so Mr. Ellery informs me.

The north drive is along a strong reef averaging 7 feet near the incline workings, and from which crushings taken 3 feet and 4 feet wide yielded 5 dwt., and up to 1 oz. from one parcel. The *Advertiser* records which I have in my possession give some of the incline yields, which total 457 tons for 261 oz. (amalgam), or 11¼ dwt. (amalgam) per ton.

At about 184 feet in the north drive, and past the rise which connects with the blind shaft sunk from the 523-ft. level, the Little reef came only to within 10 feet of the bottom level, having made into a big spurry reef formation 4 feet to 8 feet wide, as recorded in the last half-yearly report of the old company in 1883.

In the extreme north end, the reef is only narrow, ranging from 2 feet to a mere track; underhand stoping was carried on for a depth of 15 feet by a length of 30 feet, and the stone crushed yielded 6 dwt. per ton. From the end of the north drive a western cross-cut has been put in 20 feet, cutting western spurs in eastern country; 3 feet of these spurs yielded over 3 dwt. per ton from a trial of 5 tons (*Advertiser* records).

A cross-cut, 100 feet from the shaft and going west, cut several small western quartz spurs in eastern country, and, at 89 feet in, a small well-defined lode track. At the 100 feet the cross-cut struck a very hard band, which I noted as the main dyke intrusion.

Some of the rich crushings taken from between 380 feet and 610 feet on the Little reef may be here stated from the *Advertiser* record—

Date.	Depth.	Tons crushed.	Gold yield.
2/8/61	380 ft.	55½ tons	232 oz.
17/6/61	410 ft.	38 tons	118 oz.
18/7/62	550 ft.	59 tons	303 oz.
12/11/66	600 ft. (2 feet wide)	30 tons	251 oz. 15 dwt.
29/4/67	610 ft.	45 tons	327 oz.

General.

Mariner's Reef.—Sinking the main shaft and driving north and south to test the big reef at a lower level would be a good policy, as the stone promises well and might improve as the main dyke is approached, and to the north a new make in the Little reef channel might occur, as only a short distance has been prospected under the Little reef since it pinched and made spurs below.

If the shaft were sunk 100 feet, the north drive would have to extend 400 feet north to intersect the main line of shoot. If sunk 200 feet, the north drive would have to extend 500 feet to intersect the main line of shoot.

Other Reefs.—An eastern cross-cut from the 523 ft. level would intersect the Gympie, Soldier's Hill, and Cole's reefs at about the level of the flat dyke, which also crosses those lines, as is evidenced by the occurrence of felspar in the quartz spurs along those reef formations.

All these reefs dip west towards Mariner's shaft, so the distance to cross-cut would not be as far as to the surface working on those lines. None of these lines have been worked below water level except in one case.

A few yields are as follow :—

Gympie, small 6-in. reef on big reef, ½ oz. up to 1 oz. to ton.
Cole's Reef, large reef, 996 tons yielded 1,115 oz. 15 dwt.
Soldier's Hill, big formation, 1,684 tons yielded 880 oz. 17 dwt.

At the present bottom level there is a possibility that the big reef in the south drive might improve if driven on further to the south.

Since Mariner's reef was last worked, the cost of mining has diminished and improvements have been made in the treatment of ores, so now by the aid of cyaniding and the sale of auriferous concentrates low-grade quartz which would barely pay then, might be profitably mined.

In recent years the old Mariner's tailings have been profitably cyanided ; and records show that the old pyrites concentrates were worth 3 oz. to 4 oz. per ton of concentrates.

So, with the present-day improvements in mining and ore treatment, and considering the promising large low-grade quartz bodies exposed in the bottom level and along other adjacent reef lines, it may be said that Mariner's reef is well worthy of further development at the present bottom level and at deeper levels ; and that the other adjacent lines are well worth prospecting at a depth by an eastern cross-cut from one of the levels.

It was for this purpose the present company was formed, the winding plant erected, and the main shaft cleaned out and repaired to 632 feet.

In the last half-yearly report (1883) the manager of the Bendigo company stated that 1s. in calls had been made in two years, and that he was still of the opinion that the mine was valuable, and would pay if further prospected.

The dykes and their relation to the reefs were previously unnoticed, and are specially valuable as indicating that the reef formations will continue downward, besides having an apparent effect on the auriferous contents of the reefs.

I have to thank Mr. Williams, the present manager, and Mr. Ellery, who worked with the last company, for much valuable information and assistance.

[*Report sent in 27·11.07.*]

THE PRINCE OF WALES MINE, AMHERST, NEAR TALBOT.

By A. M. Howitt.

This report is based on information obtained from personal interviews with some of those who worked in the mine in the "seventies," from my observations on the line of reef, and from records in the *Talbot Leader*.

The Prince of Wales reef is situated in the State forest, 2 miles north-east of Amherst township, and 1 mile west of the Daisy Hill State school, parish of Amherst. It was first worked in the "sixties," but yields at that time are not obtainable.

The reef is in a well-defined channel in Ordovician strata, making in blocks of well mineralized, highly laminated quartz. It dips 70 deg. to the west, and its general strike is N. 20 deg. W.; the slate and sandstone beds strike N. 10 deg. W. This difference of strike causes displacements along the line; where the reef abuts on hard sandstone beds, it is moved to the east as it is traced northwards. Two of these displacements are seen; one to the south of the Prince of Wales main engine-shaft and another near the Perseverance engine-shaft on the north hill; between them the best blocks have been mined. (Plate XXIII.)

The beds through which this line of reef trends are medium-grained yellow sandstones, green to yellow-pitted slates, and some black pitted slates containing pyrites, and running close to the reef. These strata dip from 70 deg. to 80 deg. to the east, and succeeding them are harder and coarser sandstones apparently on an anticlinal, since softer beds dipping west occur 2 chains further to the west; through these beds the small reef known as "The Emu" trends.

Eleven chains south of the main Prince of Wales shaft there is a nearly horizontal dyke, apparently minette, which appears to have its origin directly to the west, where a deep shaft has passed through surface dyke rock and dyke rock of a hard nature, such as would occur near water level, thus indicating the position of a main vertical dyke just west of the reef. This dyke should influence the southern portion of the line, and also be adjacent to the main south workings at the engine shaft, as here there is evidence of its presence.

The outcrop of the reef has been prospected a little, and 6 chains south of the main Prince of Wales engine shaft, where it crosses a gully that yielded rich alluvial gold, a small trial crushing yielded gold to the amount of 7 dwt. per ton. At this place the reef is narrow and the above-mentioned cross dyke, if continuous, would intersect it at a depth of about 100 feet.

From the Prince of Wales engine shaft northwards to the Perseverance shaft, a distance of 10 chains, there is a continuous line of workings in the following order:—

1. Prince of Wales main shaft workings.
2. Busch and Party's rich claim.
3. Fentel's rich claim.
4. Lubie's claim.
5. Perseverance United Co.'s workings.

Then follows a fault to the east and other workings to a depth of 60 feet in places.

The main Prince of Wales engine shaft is stated to be 240 feet deep and measures 9 ft. 6 in. by 4 ft. 6 in. Mr. C. Ohlsen, one of the last who had a tribute in this portion of the reef, informs me there is a good reef going south underfoot. The stone his party mined was 4 feet wide; 1 foot of quartz on the footwall was payable and yielded up to 11 dwt. of gold

per ton, but the return for working the full thickness was only about 3 dwt. per ton. Water level is reported to be about 100 feet from the surface, and a 10-in. lift pumping 3 or 4 hours a day controlled the water.

This Prince of Wales Co. had its own battery for some time, but the earlier crushings were made at Cosstick's battery about 2 miles distant and at the Craigie battery 4 miles away. Mr. Ohlsen also informs me that the reef was stoped in places between the 140-ft. level and the 240-ft. level, and that the stopes at the 140-ft. level broke through to Busch's claim on the north of the gully.

To the north and just across the gully from the main engine shaft, there are the old workings of Busch and party, who mined a highly payable shoot to a depth of 130 feet by a whim shaft. Here the stone was 4 feet wide, and a large quantity of ore was crushed for yields up to 1 oz. and more per ton, stone of that value going into the Prince of Wales Co. No definite information as to the length of Busch's shoot can be given, but surface workings and stopings exposed at surface show that it was at least 40 feet long. Authentic yields are appended.

Further north was the old claim of Fentel and party; here the workings show that a shoot 70 feet long was mined. These, together with the adjacent stopes of Busch's claim, indicate that a shoot about 110 feet long was worked and it is said to have been taken out to a depth of 130 feet. Yields from this claim, taken from the *Talbot Leader*, are appended.

Further north again is the claim worked by Lubie and Party in 1876; it yielded over ½-oz. of gold per ton and up to 1 oz. In 1877 this claim was purchased by the Perseverance United Co.

The Perseverance United Co. held a 10-acre lease in 1876, just north of Lubie's claim. The main engine shaft (7½ feet x 4 feet) was sunk to a depth of 225 feet. Contemporary notes in the *Talbot Leader* show that at 130 feet the reef was mineralized, and 4 feet wide. In 1877 the shaft was 185 feet deep and the water making at 100 gallons per hour. At a depth of 225 feet a crosscut intersected the reef at 25 feet. The reef was here 2 feet wide and gold-bearing.

In July, 1878, the half-yearly report of the company showed the stone to be 3 feet to 4 feet in width, and the yields up to 10 dwt. per ton. Dehnert and Party, who had a tribute in 1879, worked just south of the Perseverance shaft, in a vertical shaft for 38 feet, when they cut the reef and followed it in the underlay. Here the crushings were 10 dwt. and 15 dwt. per ton, small crushings from a reef 2½ feet wide. At the same time (1879) a trial crushing from the bottom level (225 feet) did not pay. Dehnert's last crushing was 4 dwt. per ton.

In May, 1880, the Perseverance Co. closed down, and a new company known as the Talbot Quartz Mining Co. formed. In the prospectus it was stated that 1,600 ozs. of gold had been obtained from the Prince of Wales reef.

In 1881 this company unwatered the shaft again and drove south at the 150-ft. level to a point 247 feet from the shaft, and at the same time they put up a rise which broke through at 30 feet into Lubie's old stopes, but no crushings are recorded.

It therefore appears that only one trial crushing was taken from the bottom level (225 feet), and that at the north end of the workings very little, if any, developmental work was done below a depth of 150 feet.

Again in 1883 an attempt was made to float the mine, under the name of the Mount Emu G.M. Co.

The last work on the main portion of the reef line, between the Prince of Wales main shaft and the Perseverance main shaft, was carried out in 1881.

General locality plan

PRINCE OF WALES & EMU REEFS

AMHERST

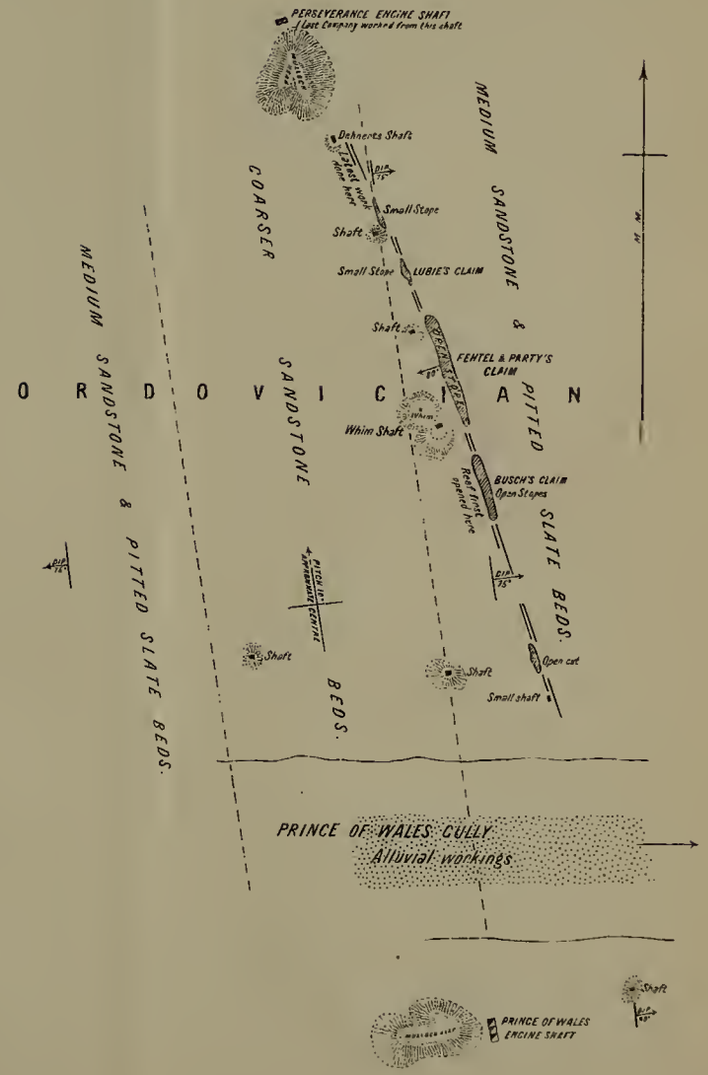
Scale,— 4 chains to 1 inch

Sketch plan

PRINCE OF WALES REEF

AMHERST

Scale - 120 feet to 1 inch.



BRITISH MUSEUM
NATURAL HISTORY

In addition to the above I quote some general statements from *The Mineral Resources of Amherst and Talbot*, by G. D. Reid, page 16:—

"From the Croydon battery (Cosstick's) I find a total of 3,234 tons crushed for 1,324 oz. 9 dwt. As in previous cases the result of every third crushing is appended:—

Tons.				oz.	dwt.
20	..	..	..	5	10
2	..	..	..	5	0
80	..	..	..	30	0
65	..	..	..	26	0
20	..	..	..	12	12
43	..	..	..	14	18
107	..	..	..	29	15
57	..	..	..	16	10
86	..	..	..	44	0
100	..	..	..	29	14
104	..	..	..	43	13
78	..	..	..	39	0
204	..	..	..	60	0
39	..	..	..	28	0
13	..	..	..	6	9
39	..	..	..	24	15"

He also states:—

"The stone was somewhat variable in width in places up to 10 feet, but the bulk may be said to be three feet or four feet, which is a nice width to work."

The shoots are said to pitch north at 45 deg., but as to their length at a depth no information is obtainable as far as I can find out; but as before stated, a shoot over 100 feet in length on the surface was worked in Busch's and Fentel's claims together.

Appended are some of the yields and notes which appeared in the *Talbot Leader* between 1870 to 1883; those in the sixties are not at present obtainable.

Date.	Tons.	Ozs.	Remarks.
25.10.70	..	..	Reef cut at 110 feet deep.
21.3.71	15	30	
24.8.71	6	$6\frac{3}{4}$	Fentel's claim. Surface stone.
17.10.71	6	$2\frac{1}{2}$	Fentel's claim.
16.6.73	1	per ton	3 feet wide.
24.11.73	71	$169\frac{1}{4}$	
13.3.74	28	48	5 feet wide.
31.8.74	80	72	4 feet wide.
21.4.74	30	60	3 feet wide. Fentel's claim.
19.5.74	40	23	
14.7.74	40	18	Fentel's claim.
3.11.74	43	$34\frac{1}{2}$	Fentel's claim.
21.4.74	145	67	Busch's claim; $3\frac{1}{2}$ weeks' work.
18.8.74	82	70	Busch's claim.
15.9.74	81	94	Busch's claim.
8.12.74	88	$52\frac{3}{4}$	Busch's claim.
Busch's claim—			
15.2.75	80	37	Busch's claim; 3 feet wide at 102-ft. level.
20.4.75	80	$34\frac{1}{4}$	Rubbly; easily mined; Busch's claim.
11.5.75	75	$35\frac{1}{2}$	Busch's claim.
1.6.75	80	$70\frac{3}{4}$	North boundary, Prince of Wales; Busch's claim.
22.6.75	60	$30\frac{3}{4}$	
27.7.75	120	$62\frac{1}{2}$	Busch's claim.
17.8.75	60	36	Busch's claim.
28.9.75	70	22	Busch's claim.
5.11.75	60	40	Busch's claim.

YIELDS AND NOTES—*continued.*

Date.	Tons.	Ozs.	Remarks.
Fentel's claim—			
2.2.75	46	15	Fentel's claim.
27.4.75	47	16½	Fentel's claim.
8.6.75	20	14	Fentel's claim.
8.6.75	40	10	Fentel's claim.
10.8.75	70	22½	Fentel's claim; 70-ft. level.
26.10.75	121	39¼	Fentel's claim.
24.12.75	107	32½	Fentel's claim.
24.12.75	7	4½	Fentel's claim.
Prince of Wales—			
21.3.76	34	18½ dwt.	In all, payable.
23.6.76	28	9¾	In all, payable.
Lubie's claim—			
11.7.76	81	47	Lubie's claim.
22.8.76	78	38	Lubie's claim.
Busch's claim—			
26.12.76	181	187½	Busch's claim.
Perseverance United Co.—			
30.1.77	..	..	Stone 4 feet wide.
Busch's claim—			
27.2.77	95	34	Busch's claim.
13.3.77	44	34½	Busch's claim.
Perseverance United Co.—			
3.4.77	..	..	Water, 100 gallons per hour; 185 feet deep.
Lubie's claim—			
3.4.77	13	6½	Lubie's claim.
Busch's claim—			
10.4.77	30	9	Busch's claim.
Perseverance United Co.—			
24.4.77	..	..	Will sink to cut shoot from Busch's and Lubie's claims.
Busch's claim—			
11.5.77	100	47½	Busch's claim.
Lubie's claim—			
11.5.77	31	16¼	Lubie's claim.
Busch's claim—			
12.6.77	62	18	Busch's claim.
Perseverance United Co.—			
13.11.77	24	11¼	Perseverance United Co.
5.3.78	109	13¾	150-ft. level; Perseverance United Co.
16.4.78	130	18	Perseverance United Co.
17.5.78	105	29	Perseverance United Co.
31.5.78	48	10½	Perseverance United Co.
Busch's claim—			
5.7.78	11	7¾	Upper levels, near Perseverance United Co.
Dehnert's—			
7.1.79	..	..	Dehnert's tribute.
31.1.79	195	32¼	Dehnert's tribute.
27.3.79	20	10½	Dehnert's tribute.
15.7.79	20	15½	Dehnert's tribute.
29.7.79	..	..	Reef 2½ feet wide; crushing at 225-ft. level not paying.
26.8.79	27	11¾	
14.10.79	..	..	4 dwts. per ton; Dehnert's last crushing.

[*Report sent in 20.11.09.*]

THE CLUNES GOLDFIELD.

By E. J. Dunn, F.G.S., Director, Geological Survey.

In 1866, the writer was at Clunes, and at that time it was the most active centre of quartz mining in Victoria. The Port Phillip Company, with Captain Bland as manager, had 90 stamps at work, and energetic sinking was in progress around the original mine. To-day, there is a solitary chimney-stack and a few heaps of mullock to mark the scene of so much activity in former years. At the time these mines were in full swing the tailings were sent into the creek and with each flood they were swept down its course, and many men, so far back as 1865, earned a living, and sometimes a very good one, by treating the concentrates and fine gold that was arrested by grass in the bends of the creek.

Cyaniders are still at work, and every bit of the old sand and slimes is eagerly sought for, and where covered up even by 6 or 8 feet of soil it is uncovered and cyanided. The whole of the residues have paid handsomely for cyaniding, and it is evident that those who originally worked the Clunes reefs did not recover a large percentage of the gold actually in the quartz.

Mr. Lidgey, in 1897, in reporting on Clunes, distinctly states that the reefs there are connected with anticlines and are saddle reefs; he also states that the pitch on the north side of the creek is northward, and on the south side southward, and after an examination of the surface I can confirm these statements. The outcrop of auriferous quartz at Clunes is just due to the fact that the culmination of the pitch on the anticline occurs at Clunes. The anticline is exposed a few feet to the east of the old chimney-stack that still stands. About 4 chains further north the beds dip west and pitch north at about 20 deg. In a small gully in the old lease of the New North Clunes Company there is also an anticline. At a distance of 1½ chains east from the old chimney-stack an eastern "leg" was worked at the surface. This pitches northward at about 15 deg. The country rocks exposed and on the dumps consist of Ordovician slates, sandstones, and mudstones, but it would be difficult to assign them to their proper zone without the evidence of fossils.

It is mentioned by Mr. Lidgey, as a reason for the failure of the most northern company (The New North Clunes Consols) that the pitch would probably carry the productive zone so rapidly down that their workings would be much too shallow to reach it, and this is undoubtedly the case.

At the time these very productive saddle reefs were worked, nothing was known about their structure and relations to the country rock and to one another, but, with the facts now established, it is clear that this field should be again opened with two definite objects in view—the one to sink deeper on the anticline, so as to prove whether there are not equally rich auriferous saddle reefs below those already worked; the other to attempt to work at greater depths, both north and south, the reefs already worked at the highest point of the pitch. It is not conceivable that the productive zone terminates where the workings leave off.

The water difficulty is not likely to be a heavy burden, because there is no alluvial water to deal with, but merely what is natural to the rock itself.

Should an attempt be made to re-open these mines—and it ought to be done—a small capital would be of little service. for, as the ground is bare, the plant would have to be purchased and erected. The old

workings would have to be unwatered, and sinking and cross-cutting operations have to be carried out on an extensive scale, and several years' work would be necessary to prove the value of the ground.

The old workings do not appear to have reached below 1,000 feet, and the most promising way to test the ground at first would be by sinking ing to discover a repetition of the saddle reefs. Later on, the extension north and south of the known productive zone could be searched for, but this would entail much greater depths of shaft sinking than the search for recurring reefs.

[*Report sent in* 17.5.09.]

GEOLOGICAL NOTES ON DEEP LEADS IN THE LODDON VALLEY.

By E. J. Dunn, F.G.S., Director, Geological Survey.

A Post-tertiary Fault in the Berry United Mine, near Clunes.

In the Spring Hill and Central Leads Mine, which adjoins the Berry United Mine on the south, extensive subsidence has taken place to such a depth as to have rendered the working of the rich deposit of ancient river gravel impossible. The site of this subsidence is marked on the surface by an extensive hollow, and the shaft was sunk right in this area, with disastrous results to the shareholders.

Underground in this mine the evidences of subsidence are very distinct, and sections indicating this have been previously furnished; they show the overlying basalts faulted down below the washdirt, pebbles from which have been carried down the fault between the basalt and Ordovician beds.

In the Berry United Mine a most instructive section of a fault occurs in No. 6 rise west of No. 2 Balance shaft. (Fig. 26.) A fault dipping 30 deg.

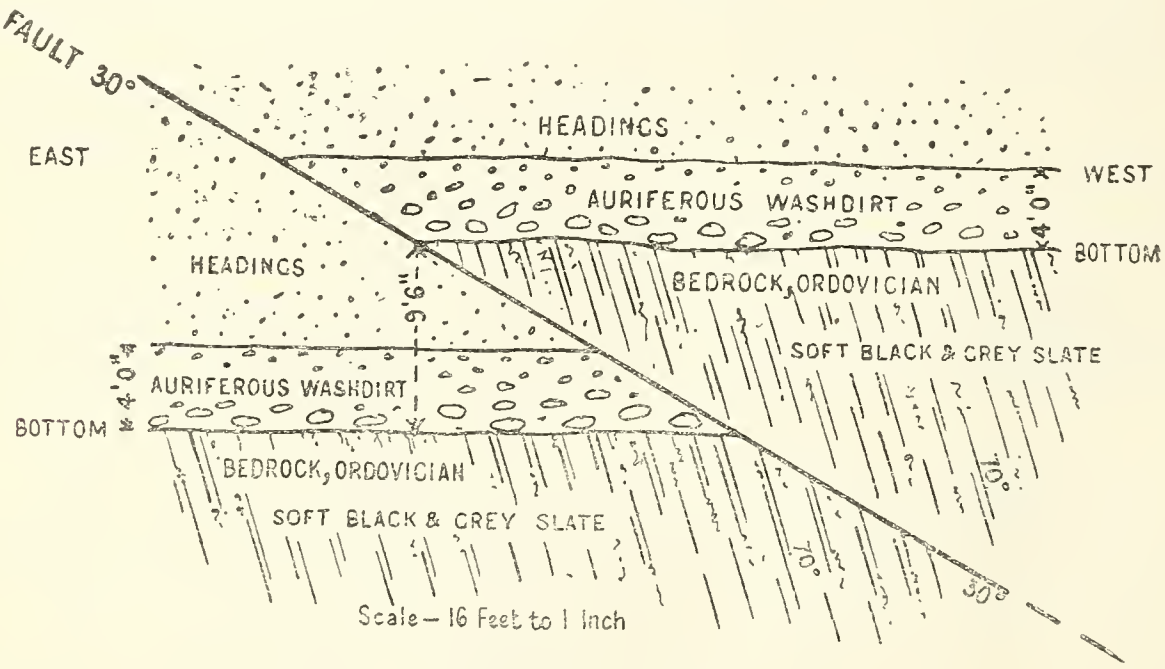


Figure No. 26.

Vertical Sections showing Post Tertiary Fault, in No. 6 Rise west of No. 2 Balance Shaft, Berry United Mine, near Clunes. Scale 16 ft. to 1 inch.

W. cuts through the alluvial deposits and the underlying black and grey soft slates of Ordovician age that form the bedrock. In this case the displacement is not that found in a normal fault, but the rock on the upper side of the fault has been pushed upwards. The vertical rise amounts to 9 ft. 6 in., measuring from the bottom of the washdirt below the fault to the bottom of the washdirt above the fault. A bore hole might be drilled so as to cut 4 feet of wash, then 5 ft. 6 in. of bedrock (soft slate), another 4 feet of washdirt, and then bedrock again; or, if the

displacement had not been quite so great as it is, 8 feet of washdirt might be drilled through before bedrock was reached, although only 4 feet of washdirt actually exists. On the other hand, if there had been a downthrow above the fault, a hole could be drilled to bedrock without touching washdirt, although there would be 4 feet of rich washdirt, perhaps, within a few inches of the bore. The anomalies that frequently occur in boring for these tertiary leads are, no doubt, largely attributable to earth movements of a similar nature.

In the neighbourhood of this mine volcanic activity on a vast scale took place subsequently to the laying down of the rich gold-bearing gravels, and enormous quantities of rock material were ejected and poured out from the craters, the principal of which was Moorokyle, which is near to this mine. The subsidences and faults may have been caused through the rocks settling down into the cavities from which the volcanic material now at the surface was derived.

The Spring Hill and Central Leads Mine.

In the workings of the Spring Hill and Central Leads Mine there is a remarkable occurrence of volcanic ash and lava associated with washdirt. From the sections obtained (Figs. 27, 28), it appears that auriferous

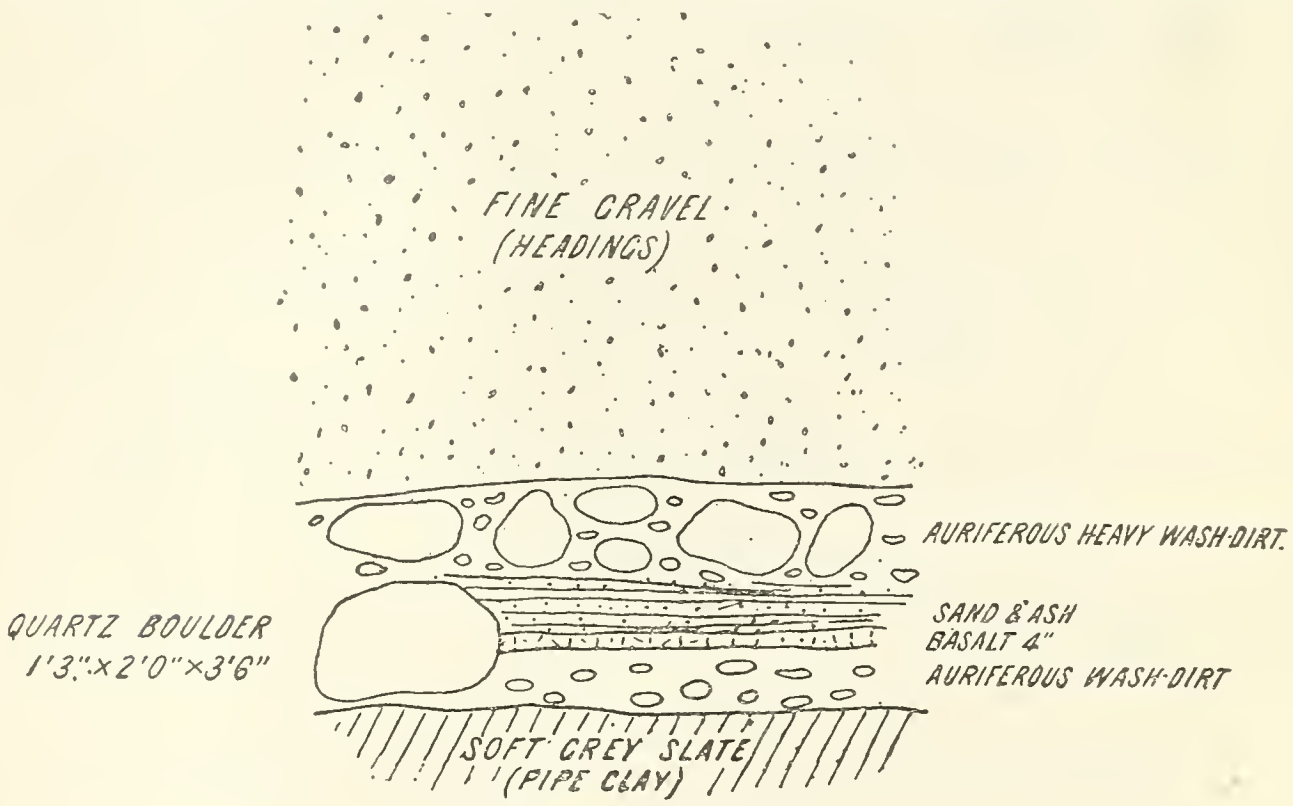


FIGURE No. 27.

SKETCH SECTION No. 2 BALANCE SHAFT, 750 FT. N.W. OF No. 3 RISE, SPRING HILL AND CENTRAL MINE. EAST SIDE OF LEVEL. SCALE, 4 FT. TO 1 IN.

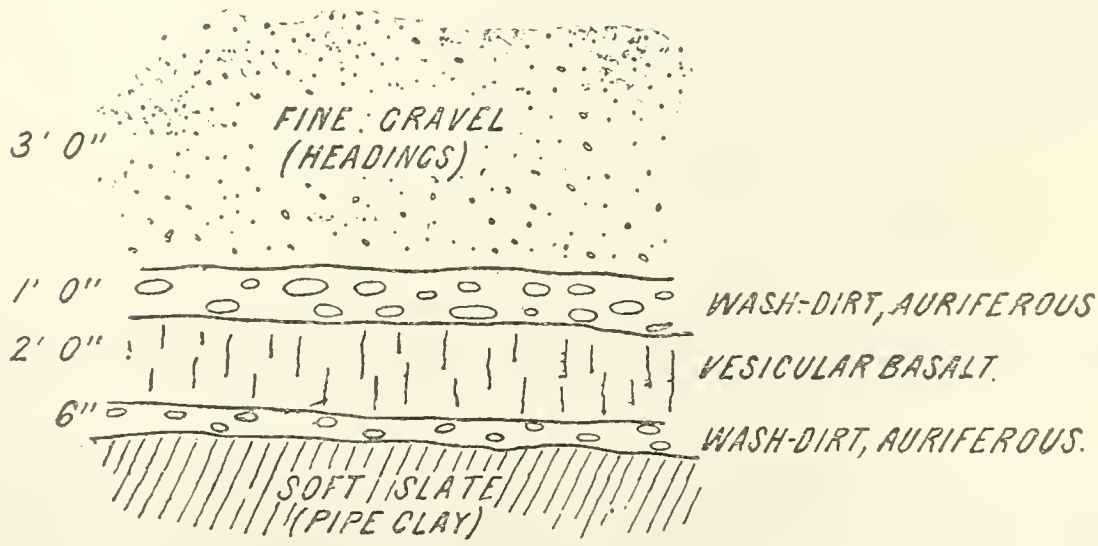


FIGURE No. 28.

SKETCH SECTION. SAME SITE AS FIGURE No. 26, BUT ON WEST SIDE OF LEVEL.

gravel and heavy boulders had already been laid down in the river bed when the eruption occurred. Lava flowed down the river bed, covering the pebbles, and in some places enfolding them. Ash was also ejected and deposited in layers over the gravel on the bed of the river. Then more gravel containing gold was deposited. The quartz pebbles that were entangled in the lava flows were affected by the heat, and, in consequence, easily crumble, while the pebbles in the washdirt above the lava are in the normal condition, and do not show any alteration due to heat. In some cases (Fig. 29), the basalt directly overlies the bedrock. At a later

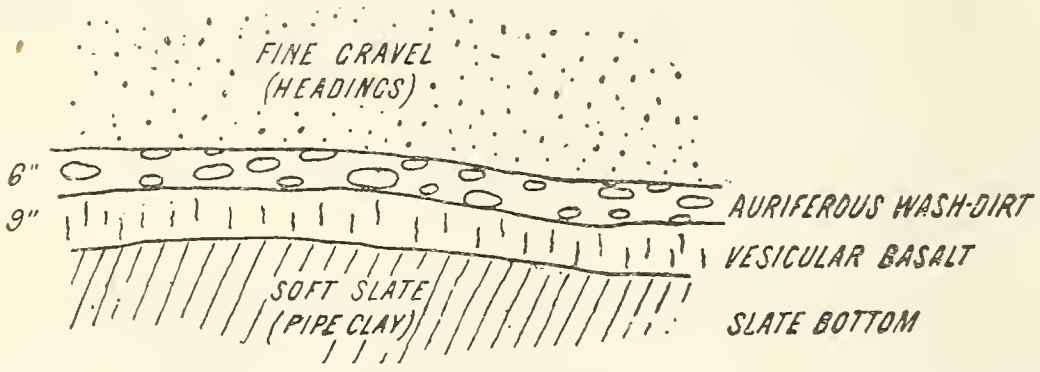


FIGURE NO. 29.

SKETCH SECTION. SAME SITE AS FIG. 27, BUT ON WEST SIDE OF LEVEL.
SCALE 4 FT. TO 1 INCH.

period, extensive subsidences occurred accompanied by faulting. (Fig. 30)

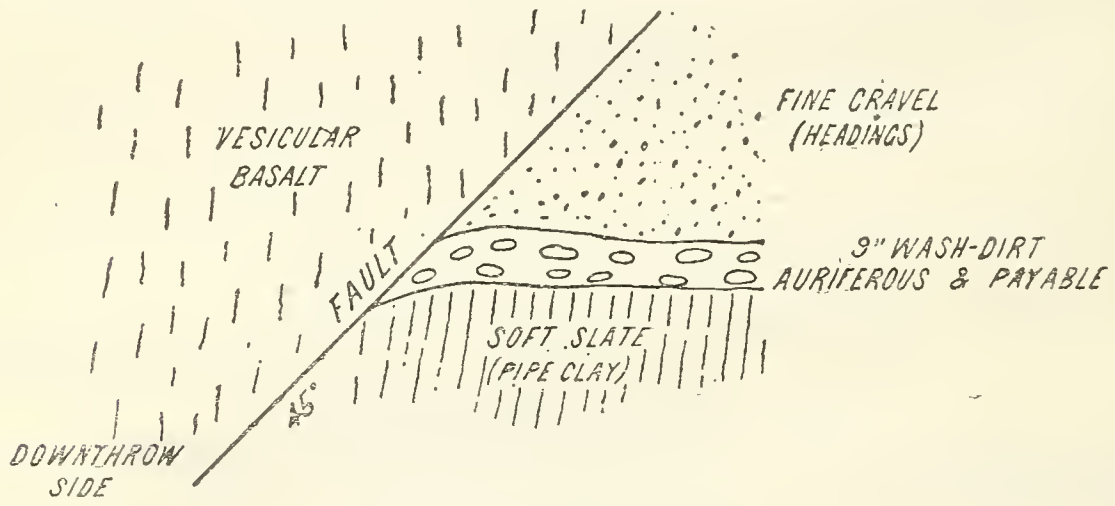


FIGURE NO. 30.

SKETCH SECTION, 100 FEET NORTH OF SECTION. FIG. NO. 27.
SCALE 4 FT. TO 1 INCH.

These phenomena doubtless gave rise to the hydro-thermal theory of the origin of these deposits.

Some of the quartz boulders in this mine were very large. Mr. Browne, junior, the mine manager, states that he saw a well-rounded boulder of quartz measuring 6 feet x 4 feet x 3 feet.

[*Report sent in 30.9.09.*]

THE CHARLOTTE PLAINS MINE, LODDON VALLEY, NEAR MOOLORT.

By E. J. Dunn, F.G.S., Director, Geological Survey.

Since my report on this mine dated 12.11.07, the principal development work done has been the extension westward of the main bottom western level, and there has also been an additional area of washdirt panelled.

No better work has been done than the extension of the main western level, for this will enable the washdirt to be tested towards the centre of the gutter.

In the former report it was urged that every effort should be made to get further into the main gutter, the edge of which was being worked from the Charlotte Plains shaft, as better returns were expected in that direction. Results have fully justified the conclusions then arrived at, for the yields obtained from the two last blocks panelled are better than from the washdirt on the edge of the channel. These two western blocks of 355 fathoms of washdirt gave 299 oz. 7 dwt. 9 gr. of gold, worth £4 per oz., or nearly 17 dwt. 1 gr. of gold per fathom. It appears that the washdirt improves to the north-west, and there is a distinct alteration in the nature of the pebbles as the main putter is worked into, as well as in the character of the gold. On the margin of the gutter, and also in the wash of the overflow worked between the Havillah and the Charlotte Plains shafts, the pebbles were somewhat angular and subangular in form, with some well rounded examples; but in the most western workings from the Charlotte Plains shaft, the quartz pebbles are distinctly larger, running up to 6 inches long, and very well waterworn, and there is an absence of angular and subangular quartz. The gold on the margin of the gutter was scaly and somewhat "branny" also, while the gold found in the last ground panelled is scaly, but much heavier, and there is very little "branny" gold present.

So far the washdirt treated has been from the outside of the elbow or bend in the lead, and as the best yields of gold are found on the inner side of the bends, the gold yields may be expected to increase the further the ground is worked towards the north-west from the shaft. The richest washdirt should be found on the opposite side of the gutter to that on which the shaft is situated.

The main western bottom level has now reached a point from which the washdirt right in the bed of the gutter can be tested, as the levels here are as low as any obtained in boring.

Mr. Bryant, the manager, suggests a programme for proving the value of the washdirt that recommends itself. It is to rise 50 feet from the end of the western bottom level, drive 200 feet west from the rise, and 200 feet east, 200 feet south, and 200 feet north, and then drive right round this block of wash so as to cut out a block 400 feet square. Then truck roads could be driven and the ground could be panelled. The total amount of driving to cut out the block of 400 feet square would be 2,400 feet. The truck roads would be in addition. An area of 4,400 fathoms of washdirt would be made available; the washdirt ranges from 6 inches to 3 feet thick.

Estimated cost of the rise	...	£50
The washdirt drive ...	...	2,160
Haulage and surface costs	...	1,200
		£3,410

This work would take from three to four months.

Eight parties of nine men in each party would panel 60 fathoms per fortnight each party, so that the whole block would take about four months to work out.

While this work was being done the main bottom west level would be driven still further west, and the next bottom level to the north could also be extended west, so as to open the mine up.

The intermediate level in the Havillah mine could also be pushed out to the west, and by this means a mile in length of the lead would soon be available for panelling.

If the north-west extension of the bottom level were made from the Charlotte Plains shaft, as previously proposed, it would be the means of cutting off the water in that direction; and if the Havillah west intermediate were driven right across the gutter it would tap the water in that part of the mine.

The present cost of pumping at the Charlotte Plains is £125 11s. 5d. per week (average of 28 weeks); at the New Havillah, £89 0s. 6d. per week; total £214 11s. 11d. per week.

The time required to get the block of washdirt 400 feet square ready for panelling would be probably from three to four months, and if the main west bottom level is extended and the Havillah intermediate level extended during that period, the future working of the mine would be greatly facilitated.

The pumping charges would be, say, £3,300 for four months, and allowing the other costs and charges for preparing the 400-ft. block to be £3,400, and a further sum of £3,300 for extending the main and intermediate levels, a sum of £10,000 would be required, and this should suffice to place the mine in a self-supporting position, if the ground in the 400-ft. block proves of as good value as the last ground panelled.

It is proposed to form a company, and if this is done and half the above amount raised to continue operations, I recommend that assistance to the extent of the other half should be granted, for the plant is exceptionally good, the prospects of the mine, as the main gutter is opened up, are most encouraging, and the mine is in thorough working order, so that the washdirt could be effectively dealt with as soon as it is found to be profitable.

[*Report sent in 8.7.08.*]

THE NEW HAVILLAH AND CHARLOTTE PLAINS MINES, LODDON VALLEY, NEAR MOOLORT.

By E. J. Dunn, F.G.S., Director, Geological Survey.

New Havillah Mine.

The collar of the shaft at this mine is 723 feet above sea-level, and the plat of the main reef-level is 372 feet above sea-level.

The main reef-level runs out 1,235 feet north-westerly from the shaft, and it is 51 feet below the bottom of the lowest floor of the wash-dirt now being worked. An intermediate level connected with the main level by a jump-up has been extended for nearly 1,000 feet still further to the north-west. This intermediate level is 17 feet below the lowest point of the wash in the present workings. A wash-dirt level has been pushed out 365 feet still further north-west. Near the end of this drive the wash-dirt is 2 ft. 6 in. thick; it is very wet, and is rapidly dipping underfoot in a north-westerly direction. Shafts over 4 feet deep had to be sunk in the floor of the level to reach the bedrock, and nearly all the water in this mine bubbles up from this most north-westerly wash-dirt drive, suggesting that the main gutter is in this direction but still further north-west. The wash-dirt may be on the outer edge of the main gutter.

The principal operations in wash-dirt in this mine have been 1,400 feet to the south-east of where the main gutter appears to be. The wash-dirt in the eastern gutter is from 120 feet to 250 feet wide, and ranges in thickness from 3 inches to 18 inches. The quartz pebbles in the wash-dirt are of moderate size, and it appears to be an overflow branch from the main channel. The floor of the lead, so far worked at the New Havillah, consists of glacial conglomerate.

The Charlotte Plains Mine.

The shaft of this mine is about one mile north-east from the New Havillah shaft. In the western workings, which are 3,000 feet from the shaft, wash-dirt has been panelled that greatly resembles the eastern gutter wash in the New Havillah Mine; it is probably the continuation of the same eastern gutter, and it may be expected to run into the main gutter to the north-east of the ground panelled.

Nearer the Charlotte Plains shaft, and 1,010 feet westerly from it, wash-dirt is now being panelled that is yielding 12 dwts. of gold per fathom (the manager states that 10 dwts: will pay all expenses), and the yield is improving to the north-west. The wash-dirt ranges up to 2 feet thick, and the quartz boulders in it are frequently 2 or 3 cwt. each, and some are half-a-ton in weight, all beautifully rounded and waterworn. The character of this wash-dirt is entirely different from that panelled in the western workings of this mine and from that worked in the eastern gutter of the New Havillah Mine, and it has all the appearance of being wash in the main gutter. In fact, this wash-dirt, though high up on the reef, appears to be the eastern edge of the wash in the main gutter. From the various bores and workings it also appears that the wash-dirt being panelled 1,010 feet west from the shaft is on the outside of a bend in the lead. The eastern gutter will probably run into the main gutter.

This heavy wash, yielding an average of 12 dwts. of gold per fathom, is certainly on the outside of the bend, and it is to be anticipated that, as work is continued in a north-westerly direction, the yield will improve, for only the poorest portion of the wash can be expected where the ground is being panelled. Already wash-dirt has been proved over a width of about 400 feet, but the lead is likely to be much wider at this part as there appears to be a great bend. The deeper gutter, and the thicker and richer wash-dirt are to be expected at and beyond the position of No. 1 bore.

At 50 chains, nearly due north of No. 4 bore, Charlotte Plains Mine, in allotment 14 B3, Sec. 3, Eddington, the bedrock has been proved by boring to be 374.64 feet above sea-level, and 36.93 feet below the bed-rock level at No. 1 bore, Charlotte Plains Mine (411.57 feet). This appears an unusually heavy drop in the floor of the lead unless there is deeper ground near No. 1 bore, and this is to be expected, for the floor in the most north-eastern wash-dirt drive in the Charlotte Plains western workings is 410.7 feet above sea-level at 2,000 feet higher up the lead than No. 1 bore.

As in the extreme north-western workings at the New Havillah Mine, so in these workings the water is coming in from the north-west workings of the Charlotte Plains Mine.

The position in these two mines is that after stupendous efforts and an enormous expenditure, the water difficulty has been overcome and the ground drained so far that the reef washes have been, and are being, worked. Part of the wash has been nearly payable, and what is being panelled at the Charlotte Plains is reported as more than payable. From

the various levels and from the manner in which the water comes in from the north-west edge of the workings, and also from the manner in which the wash-dirt dips underfoot in the extreme north-western wash-drive of the New Havillah Mine, and has a tendency that way in the Charlotte Plains Mine, and also from the entirely different character of the wash-dirt in the workings 1,010 feet from the latter shaft, there is every reason to believe that the main gutter has only been touched so far in the 1,010 feet workings of the Charlotte Plains Mine, and, perhaps, in the extreme north-western wash-dirt drive in the New Havillah Mine. To prove this matter, which is of vital importance, the New Hayillah north-west intermediate level should first be pushed out, but with very great precaution, for another 800 feet in a north-westerly direction, and later the extreme northern reef-level of the Charlotte Plains should be also continued for another 800 feet, swerving from its present course so as to reach a point a little east of No. 1 bore. The cost would be about £1 per foot.

If a main gutter is disclosed then there would be 3 miles of gutter available between the Charlotte Plains Mine and the Chalks No. 3 boundary, which could be panelled out if two shafts are sunk at proper intervals between the New Havillah shaft and the Chalks No. 3 boundary.

It is a most encouraging feature that, in the Charlotte Plains Mine, the portion of the wash-dirt on the outer side of the bend (that is certainly inferior to what exists further north-east, or on the inner side of the bend) yields so much as 12 dwts. of gold per fathom. Richer ground may be expected as the opposite margin of the lead is reached.

[*Report sent in 12.11.07.*]

THE NORTH LANGDON MINE, BENDIGO.

By E. J. Dunn, F.G.S., Director, Geological Survey.

This mine is 4 miles south of Bendigo, and situate on a ridge about a quarter of a mile north of the Thistle Mine. It is on the Thistle Line of reefs. Over 30 years ago this mine was extensively worked, and it is reported with good results. Certainly a very large bulk of quartz was extracted. The reef, which has somewhat the appearance of a saddle reef pitching rapidly northward, was of great thickness, ranging up to 15 to 20 feet and tapering out on the western portion to a foot or so thick.

The shaft is sunk to a depth of 410 feet. At 130 feet, a large body of quartz occurs, then curves around the north side of the shaft, and the country on the west side appears to conform to it. There are no east cross-cuts open. At 170 feet deep, and 17 feet west of the shaft is a well-marked wall that dips west about 60 deg. A large body of quartz has developed on this wall and it bends around to the north of the shaft. The quartz pitches north rapidly. At a depth of 220 feet, and 30 feet west of the shaft is a wall and channel dipping 65 deg. W. The pitch here is 23 deg. N. The slate and sandstone between the shaft and this wall all dip west. A large quartz body has been worked on the continuation of the west wall in a northerly direction to the northward of the shaft, and round to the eastward, but the east workings were not accessible.

At a depth of 280 feet, and 60 feet west of the shaft the wall was cut dipping west at 70 deg., and pitching north at 47 deg. There is a large body of quartz on the west side of the shaft that resembles a saddle reef. This has been worked to the north of the shaft on a considerable scale. At each level as depth increases this body of quartz is met with further north from the shaft.

The reef was cut at the 340-ft. level in the west cross-cut 90 feet from the shaft; it dips 71 deg. W., and pitches 18 deg. N. There is some quartz in the channel where cut, but it rapidly expands northward and develops into a very large quartz reef north of the shaft.

The great amount of work done on this body of auriferous quartz in the early days is good proof that a valuable reef has been worked down to this level. The reef is continuing its course below the present workings. It is necessary to sink another 60 feet, and then to cross-cut and drive along the course of the reef at the 470-ft. level. This work should be undertaken, as it is the proper method of developing the mine. The manager (Mr. Samuels) informs me that in the quartz left standing there are considerable quantities of ore that would yield 2 dwt. of gold per ton; a little more than this could be made profitable, and with such large bodies of quartz and the certainty that the same quality of stone as worked before would pay handsomely now, there is every inducement for doing the necessary development work to test the reef at the lower level.

[*Report sent in 28.6.09.*]

THE LANGDON MINE, KANGAROO GULLY, BENDIGO.

By E. J. Dunn, F.G.S., Director, Geological Survey.

This mine is situate about 4 miles south from Bendigo. The rocks are of Ordovician age, and apparently well up in the series, or, perhaps, in the lower portion of the Castlemaine zone.

The shaft is sunk to a depth of 320 feet, and at 290 feet a crosscut is driven east for 195 feet. At the shaft the grey sandstones and slates dip east, and at 75 feet in the cross-cut a reef was cut that conforms to the bedding planes (a leg); it is from 1 foot to 2 feet thick. From this point a level has been driven northward for 75 feet, and in the face the quartz, which is laminated, is 6 inches thick, and dips 54 deg. to the east. At the cross-cut there is no pitch, but further along this level the pitch is northward at about 5 deg. The south level has been driven for 233 feet on a reef from 2 to 3 feet thick. Overhead, the quartz has been stoped for 50 feet part of the way and for the rest right up to the surface. In the face at the south end of the level the quartz is about 8 inches thick with spurs in the footwall. The dip is to the east and the pitch is from 8 deg. to 10 deg. to the south. This reef is the west leg of a syncline reef or trough reef, therefore the saddle reef is at the bottom, and the two legs point towards the surface.

At 105 feet from the shaft, in the crosscut, another thin "leg" of quartz, about 3 inches thick, is cut. The reef is laminated, and dips east at 45 deg.; it is in black slate. At 175 feet in the east cross-cut the third reef is intersected. The quartz is from 12 to 18 inches thick, and in this case the cross-cut is just below the trough reef which turns up eastward, the dip both of the reef and the country rock being to the west. The westerly dip continues to the end of the crosscut. This mine was begun about two years ago, and since then a compact winding plant, and a 10-head crushing plant have been erected and paid for out of the gold won.

The special interest attaching to this mine is that it is situate on the syncline, and is about midway between the Thistle and Christmas lines of reefs. These two lines of reefs are on the anticlines.

At Bendigo, workings along the synclines are the exception; the anticlines have monopolized most of the mining. Judging from the results obtained at this mine, and at one or two other sites, as well as from the rich trough reefs worked at Lauriston and elsewhere, it seems quite probable that the lines of syncline have been too much neglected. The results obtained at the Langdon mine should encourage prospecting on the synclines. Should further work prove that the synclines are worth exploiting for gold, it would practically mean doubling the lengths of the available lines, and, as the synclines have not hitherto been mined, the work would begin at the surface. As previously pointed out, shafts sunk along the synclines will have to contend with far more water than those along the anticlines.

[*Report sent in 21.9.08.*]

THE NORTH LANGDON MINE, BENDIGO.

By H. S. Whitelaw.

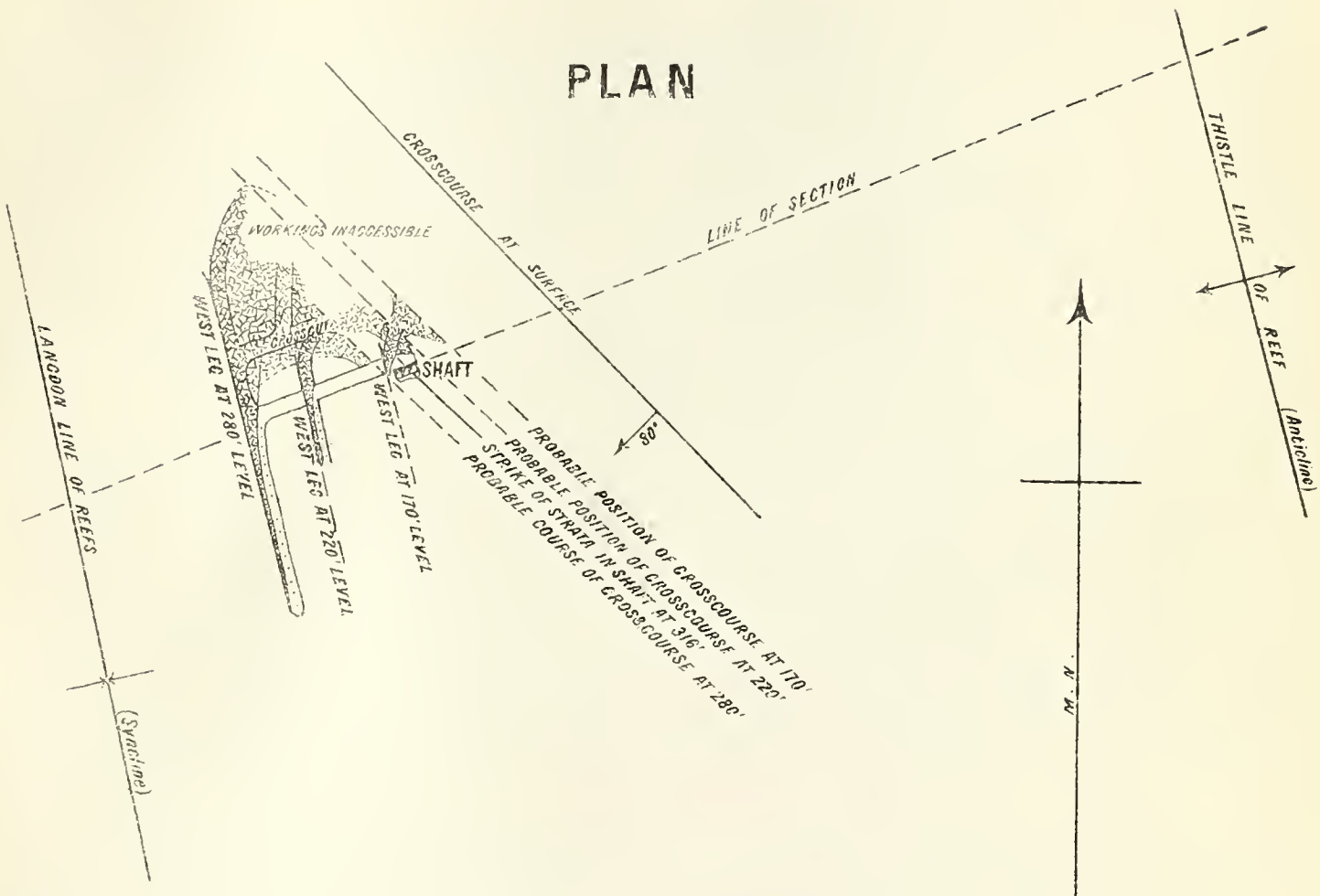
The shaft of the North Langdon Mine is on the south side of Tipperary Gully, about 610 yards north of the Langdon Mine, and 4 miles south of Bendigo. At the surface, the Langdon syncline is 140 feet to the west, and the Thistle anticline 330 feet to the east. The ground being re-opened by the North Langdon Company was rather extensively worked about 40 years ago by the Great Hope Company, and is commonly supposed to have proved one of the richest portions of the Diamond Hill section of this gold-field. The work of unwatering, enlarging, and re-timbering the shaft is still proceeding, but I was able to inspect portions of the old workings at the 170 foot, 220 foot, and 280 foot levels, and the strata exposed in the shaft between 310 feet and 316 feet below the surface. Until other sections have been exposed no safe generalization can be made, but from the little that can be seen it would seem that the shaft was sunk to cut the downward continuation of a quartz reef associated with a fault (crosscourse) which outcrops between 50 feet and 60 feet to the north-east. The wall of this reef strikes north-westerly and dips to the south-west at 80 deg. The effect of the crosscourse on the country within the lease is not plain, but that the vertical displacement is considerable is suggested by the flutings in the wall of the reef at 280 feet, and the sharp reversal of the pitch of the Langdon syncline where intersected by it. At this point on the surface the normal pitch of about 5 deg. N. becomes one of 40 deg. S. Beyond this spot, in a north-westerly direction, the crosscourse follows the course of Tipperary Gully to the Christmas anticline, which it somewhat distorts. In sinking the shaft a west dipping back was cut at 130 feet carrying 6 inches to 10 inches of laminated quartz, which, as it has been worked for a short length to a depth of 280 feet, was probably auriferous to a payable degree. About 60 feet to the east of this leg another west dipping reef (called the east leg) has been worked from 220 feet to 280 feet (to what height above and depth below these levels is not known). This reef cannot now

NORTH LANGDON MINE

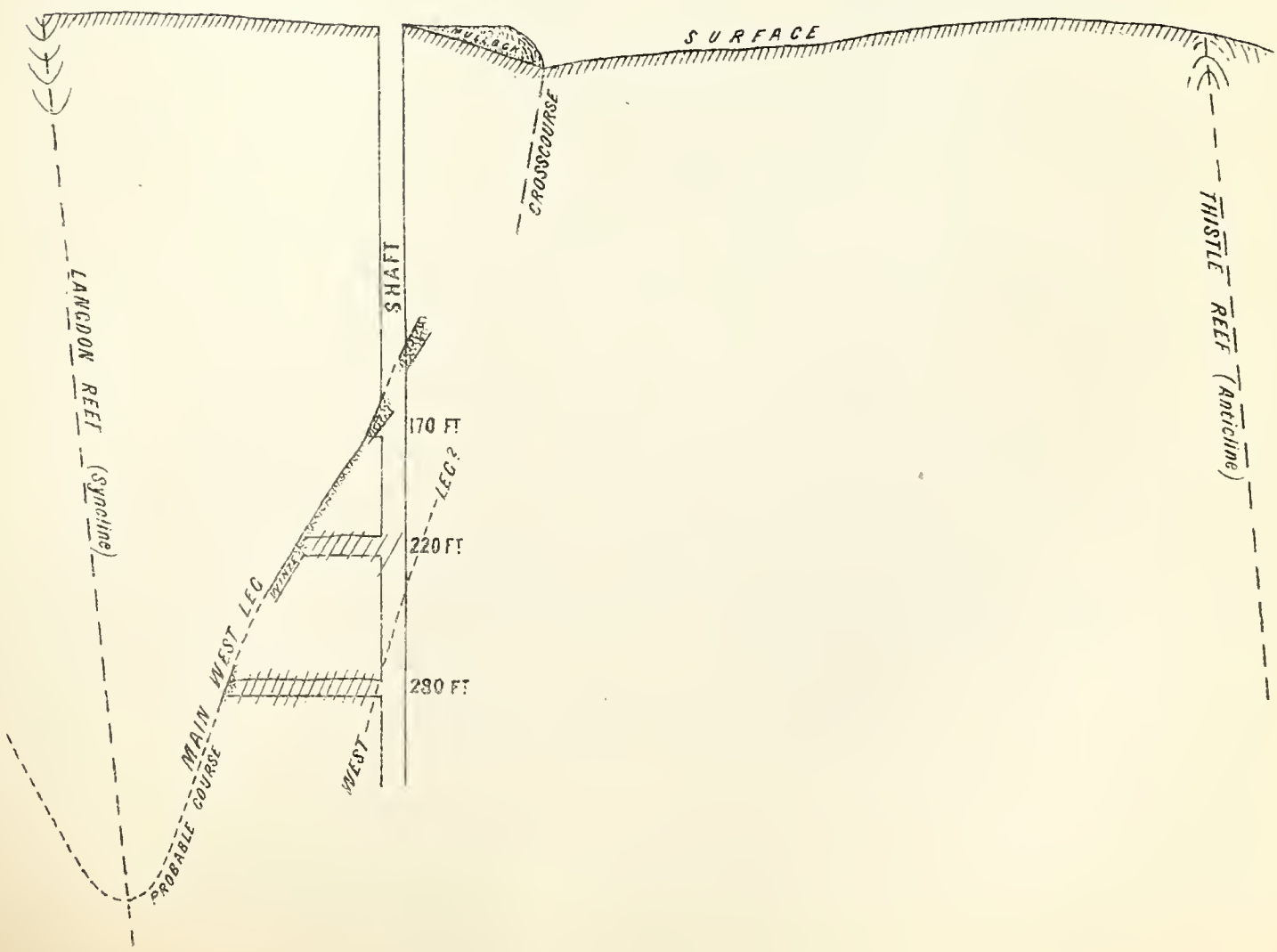
TIPPERARY GULLY, NEAR BENDIGO

Approximate scale, 120 feet to 1 inch

PLAN



TRANSVERSE SECTION



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be seen, but from the information given me by the manager (Mr. L. A. Samuels), it would seem that it may be the fault reef or crosscourse previously referred to. Both these reefs have been worked northward to a massive lunate-shaped body of quartz, apparently associated with the crosscourse, but what amount of work has been done on the latter cannot be determined until the present company has cleaned out and repaired the old levels.

Mr. Samuels, who is a keen geological observer, and who, while directing the operations of re-opening these workings, has had opportunities of noting features now hidden from view, sees a peculiarity in the form of the quartz deposits in this mine, and advances an interesting speculation on the subject. While not sharing it, I can perfectly comprehend Mr. Samuels' opinion, which is that the North Langdon shaft is sunk in centre country (anticlinal) through the cap of a saddle reef pitching to the north at an angle of 80 deg. "Consequently the company's shaft, which has hugged the cap of the reef for a considerable distance, is equivalent in its relation to an ordinary reef formation to a level driven in centre country just under the cap, or in the saddle of the latter. In practical working, it is obvious, therefore, that levels driven on either the east or west legs represent the equivalent of winzes or rises on ordinarily situated formations, as they are driven either north, in a direction towards the cap, or south in the opposite direction. A level driven in centre country will represent a centre country winze, unless the folding of the strata should resume its normal position, but there are indications on the surface, though not very well defined, that similar formations exist in a northerly direction from the North Langdon shaft."

A plan of the workings tends to confirm Mr. Samuels' conjecture, but having made a careful examination of the country surrounding the mine, I feel sure that no anticline exists between the Thistle anticline and the Langdon syncline, between which the North Langdon Mine is situate. The attached plan and section show the position of the workings in relation to the structure of the country. The main west leg is a leg, properly so called, of a trough reef, the cap of which will be found at a depth of about 370 or 380 feet below the surface. The so-called east leg is probably the continuation of the crosscourse seen on the surface. Making due allowance for the pitch of the country, it is probable, as pointed out by me in notes on the Langdon lines, sent in on 6/4/08, that the main west leg in this mine is the west dipping leg of the trough reef, of which the reef being worked in the Langdon Mine is the east dipping leg. The massive quartz styled by Mr. Samuels the cap is probably a development newer than the leg quartz, and is genetically connected with the crosscourse. It is of greyish-white colour, cavernous, much fractured, and is mixed with seams of slate and sulphide which are not always parallel with the country. On the other hand, the quartz forming the leg reef is of a bluish colour, and evenly laminated parallel to the walls. The transition from the one class of quartz to the other is abrupt, and it would seem that while the deposition of the leg quartz was a gradual process (as implied by its regularly laminated structure) that of the other was not so gradual, was later, and was the immediate result of the disturbing influence of the crosscourse. The beds exposed in this mine belong probably to the Castlemaine series. Some fossils collected from the locality were identified by Dr. Hall. (See p. 189.)

[*Report sent in 20.11.08.*]

THE BENDIGO GOLDFIELD PROPRIETARY MINE.

By E. J. Dunn, F.G.S., Director, Geological Survey.

This mine is situate about $3\frac{1}{2}$ miles a little east of south from Bendigo. The shaft (the Diamond Hill shaft) is on the top of a hill, and is 606 feet deep.

At a depth of 488 feet, in west crosscut, at 70 feet from the shaft, spurs were cut in the slate beds, and also what appears to be an east leg, with a thin vein of quartz. At 95 feet west of the shaft centre country was intersected. At 105 feet in, a dyke 4 inches thick was cut, and at 120 feet in, the west leg was cut. The pitch of the beds here is 10 deg. to the north. The level passes through a fault, which cuts off the west leg south of the crosscut. The leg is heaved 5 feet to the east below the fault.

At the 586 foot level, the slate and sandstone dip 60 deg. E. at the shaft. Centre country and a dyke 3 inches thick were cut at 70 feet west of the shaft.

In this shaft the most necessary work is to sink; cross-cutting and level driving are quite useless until greater depth has been reached, and therefore nothing other than sinking should be done for at least another 200 or 300 feet.

[*Report sent in 28.6.09.*]

THE GARDEN GULLY CONSOLS MINE, BENDIGO.

By E. J. Dunn, F.G.S., Director, Geological Survey.

This mine is situated about a quarter of a mile north from the embankment of the Spring Gully reservoir. It is on the Garden Gully line of reefs and the shaft is favorably placed for exploring them. Mr. Whitelaw has carefully followed out the lines of pitch along the anticline, with the result that the favorable (Bendigo) zone, which is most productive of gold on this field, appears to be at no great depth below the present bottom of the shaft, which is now 290 feet below the surface. By sinking another 200 feet the Bendigo zone would probably be entered, and it is in this zone, and especially in the upper portion, that saddle reefs bearing payable gold are to be expected. I certainly recommend that the shaft be sunk, say, another 200 feet, and then cross-cuts could be driven westward to intersect centre country, and to search for saddle reefs. An important feature in this case is that the zone of productive country appears to be within a moderate depth from the surface, and therefore the great expense of a deep shaft to explore the country is not necessary. Should auriferous saddle reefs be cut in the shaft and proposed cross-cuts, it would probably result in the opening up of the line for miles in length. In the present position of mining at Bendigo this is one of the sites most deserving of attention.

[*Report sent in 4.5.09.*]

CAMERON AND McRAE'S REEF, CASTLEMAINE.

By E. J. Dunn, F.G.S., Director, Geological Survey.

The site of these workings, which are of a prospecting character, is about 3 miles east-north-east from the Castlemaine Post Office, and on the north slope of a hill. The principal shaft is 100 feet deep on the dip which is 35 deg. W. A syncline passes through the site. The

workings are in sandstone and slate beds belonging to the Castlemaine zone. At 16 feet from the surface the reef was cut in the shaft; it strikes nearly north and south, but dips west; it ranges from an inch to 3 feet thick, averaging about 1 ft. 6 in. where taken out. The shoot of gold was 40 feet long, and continued for 40 feet in depth, but it has become very poor at the bottom. Several openings have been made north and south of this shaft and some crushings have been obtained, but nothing of any importance has been discovered. I do not consider this ground favorable for gold mining.

About 3 chains further east is the Fiddler's line of reef, which was extensively and profitably worked about 40 years ago. There should be a better field for prospecting on this line, as it is along an anticline and there is likelihood of succeeding saddle reefs being found below those already worked, but machinery would be required as the old workings are carried down to water level.

[*Report sent in 26.10.09.*]

THE FLAGSTONE QUARRY, SPECIMEN GULLY, CASTLEMAINE.

By E. J. Dunn, F.G.S., Director, Geological Survey.

This is the original quarry, and it has been extensively worked for over 40 years. It is 4 miles by road in a north-easterly direction from Castlemaine, and there is a railway siding but a short distance from the quarry. Ordovician beds, apparently belonging to the Castlemaine zone, form the "country." The strike of the beds is about north and south (magnetic), and the dip 88 deg. E. The belt of valuable flagstones is about 23 feet wide, and it has been worked at intervals for a length of 20 chains. At the south end a fault has broken the rocks up, so as to render them of little value. At the deepest part the quarry has been sunk to a depth of 220 feet; this is filled with water to within 30 feet of the surface. The pitch in the deep quarry is nearly horizontal. These are true flagstones separating along the bedding planes, which are smooth and even; the material is slaty, but it is not fissile like roofing slate. Flagstones from $\frac{1}{4}$ inch to 4 inches thick are obtainable, and the quality improves with depth.

There is an immense amount of valuable material available, and as the quarry has been sunk down to the depth of 220 feet, the heavy initial expenses have been defrayed, and a working face prepared. In dealing with such a quarry pillars should be left at proper intervals to support the sides. Stone of the character obtainable here is useful for building material, for paving, and for many other purposes. There is a 25 horse-power engine and planing and sawing plant at the quarry, but no work has been done there for several years. This industry should be revived, if possible, as the material, which is of excellent quality, could be utilized for so many purposes.

The new quarry is in Nicholson's Gully, at a distance of about $1\frac{1}{2}$ miles E. 30 deg. S. from the old quarry. The belt of flagstone is 17 feet in width, the flags range from 1 inch to 4 or 5 inches thick, and the material is slaty, as at the old quarry. The strike of beds is about north and south, and the dip is 82 deg. E. This quarry has been opened up for a length of 200 feet, and to a depth of 50 feet. The flags do not split so readily as at the old quarry. An engine with planing and sawing machines is on the ground, but the quarry is not being worked.

[*Report sent in 31.10.07.*]

THE CHEWTON GOLD MINES (FORMERLY THE FOREST CREEK GOLD REEFS), CHEWTON.

By E. J. Dunn, F.G.S., Director, Geological Survey.

No. 11 level is 760 feet from the surface. In the western cross-cut and 30 feet from the shaft an anticlinal fold occurs in slate. At 50 feet from the shaft is the fault along which the principal reef has formed. Below the fault the country dips east, and quartz spurs are present. A level was driven along the reef northwards for 300 feet from the cross-cut in search of the payable shoot of stone worked in the level above on the same line of fault. In the face at the north end of the level the reef is 2 to 3 feet thick, but no payable quartz was discovered. At the north end of the north level the country pitches northward at 11 deg. The country is the usual alternation of slate and sandstone beds. The south level at No. 11 level is driven 190 feet.

No. 12 level is 846 feet from the surface. A level is driven northwards for 125 feet. At the plat the slate and sandstone dip W. 80 deg., and quartz spurs are present. At 110 feet from the shaft there is a body of quartz 6 feet thick on the same fault as was opened up at No. 11 level, and which was productive at No. 10 level. The east or hanging wall dips E. at 55 deg. There is much black slate mixed with the quartz; iron pyrites is abundant, and some galena and zinc blende also occur in the quartz. Trial crushings gave about 2 dwts. of gold per ton of quartz. The pitch of the country and of the quartz is S. 18 deg. At the shaft a flat spur 9 inches thick is met with.

In the eastern cross-cut the fault and reef are met with at 20 feet from the shaft, and the east wall at 22 feet. From this cross-cut a level is driven south for 94 feet. In the south face the reef is 6 to 7 feet thick with about 1 dwt. of gold per ton of quartz. The pitch is southwards at about 18 deg.

This mine as previously described is in the Castlemaine zone, and the gold occurrences are likely to be most irregular while mining is continued in that zone, but lower down there is a probability that the reefs will become more productive, and for that reason the advice was given that any further operations should be in the direction of sinking the shaft. It is certain that below the beds in which mining has so far been carried on the more productive Bendigo zone exists, but there is not sufficient data available to definitely state at what depth this zone would be entered. Even in the lower portion of the Castlemaine zone the rocks are more productive of gold than higher up, and the advice previously tendered, *i.e.*, to sink the shaft deeper, can only be repeated.

[*Report sent in 9.7.08.*]

THE SOUTH EUREKA MINE, FRYERSTOWN, NEAR CASTLEMAINE.

By E. J. Dunn, F.G.S., Director, Geological Survey.

This mine lies in a direction a little west of north from Fryerstown, and is 2 miles distant from that place. The country rock is Ordovician, and the beds are folded into a series of ridges and troughs. At the South Eureka mine the rocks appear to be well up in the Castlemaine zone.

A shaft has been sunk 245 feet. At the 145-ft. level there is a cross-cut driven east for 30 feet, and a quartz reef 1 foot thick occurs at the end of it. Along this reef (a leg) a level has been extended northwards for

156 feet and southwards for 80 feet. A little gold was obtained, but the quartz was not payable. From this level a winze was sunk 45 feet on the course of the "leg." The quartz on top gave about 3 dwts. of gold per ton, but value decreased lower down. The shoot pitches south about 8 deg.

At the 245-ft. level the cross-cut has been driven 89 feet to the west, Twelve feet west of the shaft centre country was cut, the arch being formed of slate; at 30 feet from the shaft sandstone dipping west is met with and continues to the end of the cross-cut, where a quartz reef (leg) 5 inches thick, has been disclosed. The quartz is laminated, and contains much iron pyrites and a little gold. The east cross-cut has been driven 79 feet to a small quartz reef (leg) 6 inches thick; levels have been driven north and south along this reef without disclosing payable stone.

Immediately to the north of the shaft are Davis' old workings, and others still further north. These are reported to have yielded rich returns in the past. The pitch of the country north of the shaft is southward, and it is doubtful if the workings in the shaft are sufficiently deep to cut the continuation of the shoots of gold formerly worked to the northward.

This shaft is being sunk on an anticline, and at the surface a strong dyke runs to the west of the shaft and can be traced at the surface for many chains north and south of it. In the Spring Gully mine characteristic saddle reef structure and well developed reefs occur. This mine will probably be of the same character, but it appears to be still higher up in the Castlemaine zone. It is not advisable to expend much labour in driving levels until reefs carrying gold of payable nature are found. Sinking the shaft and cross-cutting east and west is the work most necessary to be done.

[Report sent in 31.10.07.]

THE ANNIE LAURIE MINE, TARADALE.

By E. J. Dunn, F.G.S., Director, Geological Survey.

This mine is situate on the west bank of the Coliban River, about 1½ miles in a south-easterly direction from the Taradale railway station. The country rocks consist of sandstones and slates of grey colour, and appear to be the Castlemaine beds, but no fossils were observed. At the mine the beds are folded over an anticline and pitch north at from 15 deg. to 25 deg. From the south face of a slope a tunnel has been driven, and at 124 feet in the saddle reef is cut which showed on the surface above the tunnel mouth on the slope. From the end of the tunnnel a winze has been sunk on the east leg, which is 4 feet thick, and another winze is sunk down the pitch of the saddle reef and just under it for 280 feet. The strike of the saddle reef is about N. 20 deg. W., and the dip of the east leg is 45 deg. E. The pitch of the saddle reef is to the north at from 15 deg. to 22 deg. At 56 feet vertically below the tunnel a level is driven southerly on the west leg. The laminated quartz is 1 ft. 6 in. thick, and a little gold is got in the stone near the end of the level. From the same level the east leg is driven on for 160 feet in a southerly direction. A shoot of auriferous stone 20 feet long is being worked here, but the quartz is not rich.

From the same level there is a connexion with a small whip shaft sunk from the top of the hill. There is a five-head battery, &c., driven by steam. The gold from this mine is worth £3 18s. per oz. So far this mine is in the prospecting stage; it has been shown that saddle reefs occur and that there are some shoots of gold in the reef.

To properly test this country a shaft of such dimensions that it could be taken down for a considerable depth should be sunk on the east side of centre country. There have been some profitable reefs worked in this neighbourhood, and some extensively, as in the United Kingdom mine about a mile to the west of the Annie Laurie mine, and the Phœnix mine at the north end of Taradale. When these mines were worked nothing was known about the saddle structure, and, in consequence, the top reef or so was worked out and the mine abandoned; the recurrence of one saddle reef below the other was not understood at the time.

This area is one offering great inducements for mining. At the surface profitable alluvial gold was worked in sub-basaltic gravels and in the gullies. The reefs were also payable at the surface, and there is every ground for believing that systematic mining in the lines of reefs formerly worked would prove successful if sufficient capital is expended.

The belt of auriferous country at Taradale extends from the west side of Back Creek to about a mile on the east side of the Coliban River; it would lie to the east of the Lauriston belt. Both east and west of this tract the rocks are Ordovician, but they are higher in the series, for while the Taradale belt is apparently composed of the Castlemaine beds, the country rocks both east and west probably consist of Darriwill beds, and are barren.

About 6 miles west of the Taradale belt of auriferous country is the Fryerstown belt, which also belongs to the Castlemaine beds. The rocks between these two productive belts, being Darriwill beds, are barren of gold at the surface, but below them the auriferous Castlemaine beds are doubtless continuous right across from the one belt to the other, though they may be too deep down to be profitably exploited. Below the Castlemaine beds the still more productive Bendigo beds are also probably continuous.

The following information about the yields has been supplied by Mr. Andrew Loughnan, the legal manager of the mine:—

—	Tons Crushed.	Free Gold.	Gold from Concentrates.	Total Gold Yield.
		oz. dwt.	oz. dwt.	oz. dwt.
1907—November ...	12	32 10	5 15	38 5
1908—May, June, July	30 (Odd lots.)	22 10	—	22 10
June 24 ...	55	31 0	4 0	35 0
July 31 ...	28¼	41 5	9 15	51 0
September 29 ...	49	24 14	6 0	30 14

[*Report sent in 21.10.08.*]

O'CONNOR'S FREEHOLD MINE, DRUMMOND, NEAR MALMSBURY.

By E. J. Dunn, F.G.S., Director, Geological Survey.

O'Connor's Freehold mine is at present not being worked except on the western boundary of the lease where a tunnel driven many years ago and abandoned, has been continued some hundreds of feet further eastward with satisfactory results.

The original tunnel was driven for 633 feet from the entrance and then left. At the mouth, on Back Creek, it traverses barren brown sandstones, &c. These beds are crumpled, and lie in places at a low angle. Further

in these beds dip W. and then all the beds dip W. to the present end of the tunnel which is at 1,194 feet. The beds E. of the barren sandstones are lower in the series, and they consist of soft light grey slates and sandstones. This belt of country continues to the O'Connor's reef, and is productive of gold. At 964 feet from the mouth of the tunnel what is considered to be the Queen's Birthday line of reef has been intersected. The strike of the reef is N. 15 deg. E., dip 50 deg. E. There are three veins of quartz showing in the S. level, which is driven 34 feet from the tunnel. The most easterly quartz vein is about 2 inches thick. At 1 ft. 6 in. further W. is another quartz vein from 1 to 2 inches thick. At 3 feet still further W. is the third quartz vein, also about 2 inches thick. The quartz carries gold. The country is light-grey slates, &c., pitching N. at 15 deg., and the gold shoots follow the country. As the pitch is northward, the level should be continued southward. The quartz here is oxidised, and to ascertain its character where unaltered a winze should be sunk. At a very moderate depth water will probably be struck. The dip of the country where the Queen's Birthday reef cuts through it in the tunnel is 70 deg. W.

The track of the reef is easily followed, and by driving along it the various shoots will be discovered. The rock is easy to work. The backs are shallow as the surface is only about 70 feet above the tunnel floor.

At 1,102 feet from the tunnel mouth, what is believed to be the Stackyard reef was cut. The strike of reef is N. 5 deg. W., dip about 87 deg. E. The strike of the country rock is N. 22 deg. E., dip 50 deg. W. The country consists of light-grey soft slates and sandstones. The pitch of the country is apparently about 45 deg. N. The Stackyard reef (so-called because it runs through the stackyard of the farm) is marked where the tunnel cuts it by a shoot of auriferous quartz, which is about 6 feet long on the floor of the tunnel, and which pitches N. with the country. The quartz, on being broken, shows iron and copper pyrites and particles of gold disseminated in the heart of the quartz. The quartz vein ranges from 2 or 3 inches to 7 or 8 inches thick.

It is of importance that these lines of reef should have been picked up, and if they open out like some of the reefs formerly worked in this neighbourhood, profitable mining may be re-established.

[*Report sent in 21.2.08.*]

THE MIA MIA MINE, REDESDALE.

By H. S. Whitelaw.

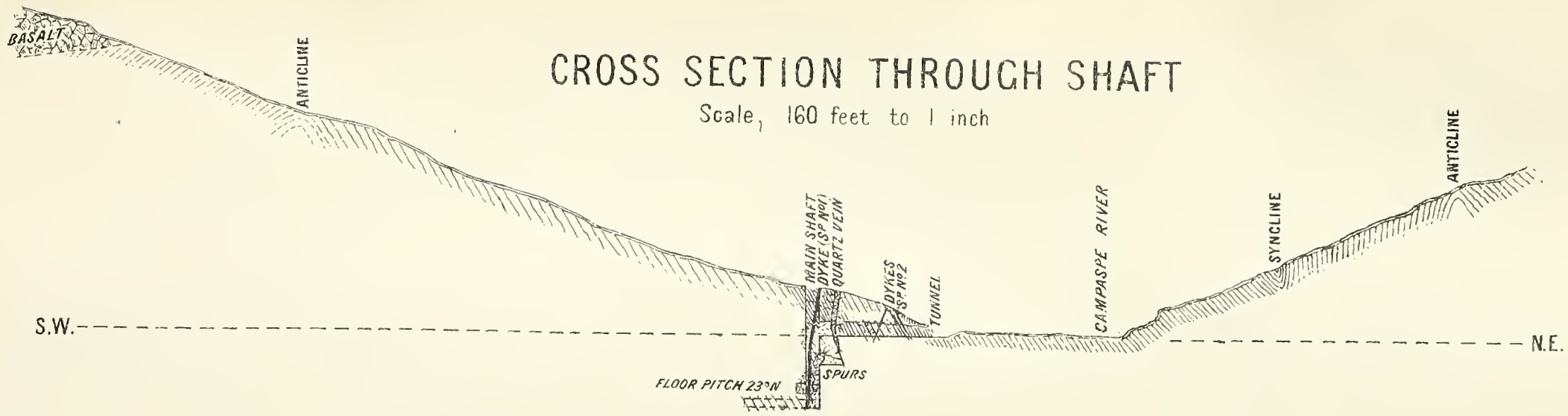
The Mia Mia mine is situated on the western bank of the Campaspe River, about 3 miles north of the Redesdale township. Reef gold was first discovered in this locality about four years ago by a party of prospectors, who found a rich specimen in the river valley. By loaming the hillside the gold was traced to its source—quartz deposits about 40 feet above the river bed. A claim was pegged out and a crushing broken which averaged ½ oz. of gold per ton, a return not quite payable under the then existing conditions. Without further prospecting, the claim was abandoned. Two years later Mr. J. Day visited the locality, sampled the surface quartz, and formed the Mia Mia Gold Mining Company, which erected an 8-head battery capable of crushing 20 tons of quartz per shift, and has since profitably worked the quartz bodies above referred to.

The company's workings were first conducted from an open cut near the centre of the lease. Here it was found that the gold shoot pitched northward, and to meet the downward continuation of it, a main shaft 7 feet x 4 feet was sunk to a depth of 30 feet. As sinking was somewhat impeded by water, a tunnel about 70 feet in length was driven from about river level to drain the workings. Subsequently a pump was installed underground, and the shaft continued to 80 feet from the surface.

The main workings of the mine are on quartz bodies associated, and probably genetically connected, with a decomposed dyke which strikes about N.W., making a small angle with the strike (N. 25 deg. W. to N. 40 deg. W.) of the enclosing rocks, and dips south-westerly at an angle of about 78 deg. The so-called main reef is an irregular quartz body 18 inches to 5 feet wide, striking N. 20 deg. W. to N. 40 deg. W., and dipping across the strata to the south-west. This formation has been stoped from the surface to the 50-ft. level for a length of about 70 feet or 80 feet. Northward the limit of the payable shoot appears to be a cross-course striking approximately east and west at a point about 28 feet north of the shaft. Here there has been fracture, but very little movement. Northward from this cross-course, southward from a point 50 feet south of the shaft, and below the 50-ft. level, the quartz decreases in size, and. though auriferous, is barely payable. On the surface gold has been traced over a length of 300 feet—from 200 feet south to 100 feet north of the main shaft. Between 50 feet and 80 feet in the shaft massive quartz spurs are exposed, and at 69 feet a floor pitching 23 deg. N. was met with in the western side of the shaft. Immediately above this floor the quartz, for a width of 4 feet, is said to be of higher value (about 4 dwt. per ton, which is not payable) than the surrounding quartz. With the intention of testing this, a cross-cut from the bottom of the shaft was driven westward for about 40 feet, but, as was to be expected from the pitch of the floor, the quartz was not met with. A level was then started from the shaft at 73 feet below the surface. and driven about 10 feet southward. At the time of my visit a commencement had been made to cross-cut west from the end of this drive, but as it is obvious that this cross-cut if driven would be no nearer the shoot than the lower one is, and, moreover, that the country is unfavorable (being a dense micaceous sandstone), work was stopped at this point and a level will be driven northward from the bottom of the shaft until the floor is intersected. If this floor is then followed until favorable country (slate) is met with, payable quartz may be struck.

Statistics of the ore crushed and gold obtained from the stopes were not obtainable at the mine, but the manager informs me that the average yield has been about 14 dwt. per ton, which is just payable.

The quartz is iron-stained, greyish-white in colour, and here and there shows gold, galena, and iron, copper, and arsenical pyrites. Judging from the appearance of the quartz, the sulphides mentioned will probably be found in fairly large quantities below the line where oxidation ceases. The ore apparently occurs in irregular shoots, formed on floors or fractures pitching to the northward at angles between 23 deg. and 40 deg. Sufficient work has not been done to throw much light on the question of the position of the shoots in relation to the associated rocks, but it would appear that the disturbing influence of the dyke has been the cause of the quartz deposits; and that there is some relation between the richness of the shoots and the nature of the country rock. For instance, where the quartz crosses a soft greenish slate, it has given higher yields than where it has passed through sandstone.

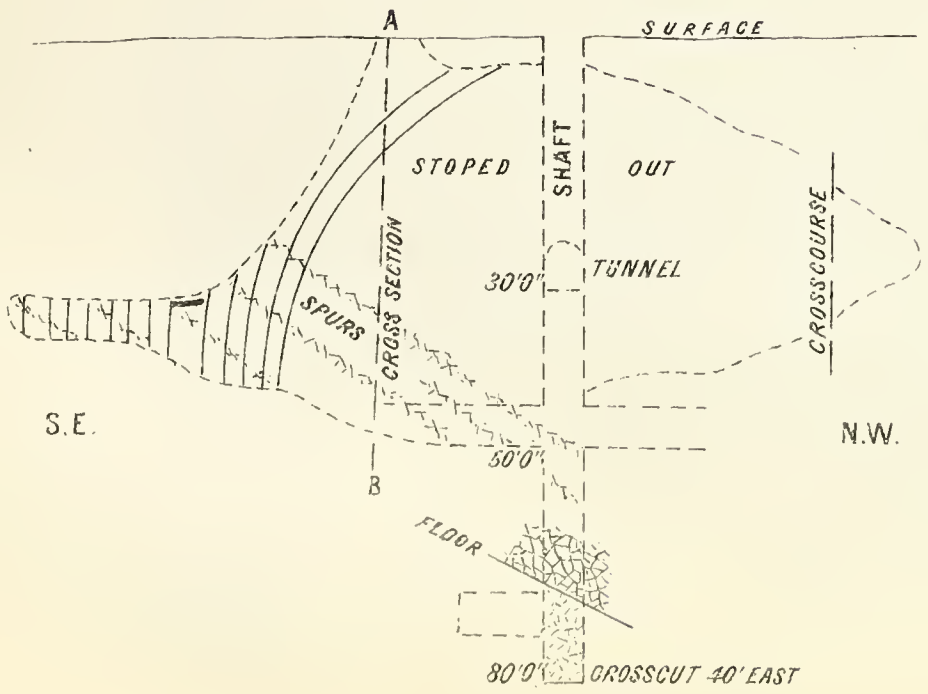


CROSS SECTION THROUGH SHAFT

Scale, 160 feet to 1 inch

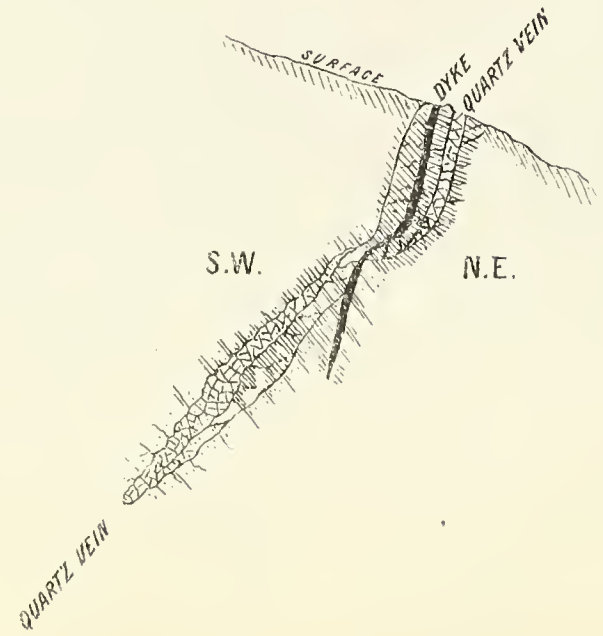
LONGITUDINAL SECTION

Scale, 40 feet to 1 inch



CROSS SECTION A.B.

Scale, 40 feet to 1 inch.



SKETCH SECTIONS
MIA MIA REEF
REDESDALE

BRITISH MUSEUM
NATURAL HISTORY

From the well-ascertained pitch of the quartz bodies it is clear that future operations in this mine, if they are to be successful, must be carried on at a greater depth, and, it would seem, in a northerly direction. My inspection of the mine leads me to the conclusion that the workings have entered unfavorable country, and that it will be necessary to follow the fracture planes connected with the dyke until they re-enter favorable country.

There are no other reef workings within 4 miles of the Mia Mia mine, and, so far as I could learn, no prospecting has been done. Physically the country surrounding the mine may be considered as an irregular basaltic plateau, through which the Campaspe River and its tributaries have cut deep valleys, exposing the underlying sedimentary rocks. These rocks are seen to be folded into anticlines and synclines, and there are definite indications of veins of ore at the surface. In every direction there is much unexplored country over which the indications are favorable, at least for prospecting.

The accompanying sketches show sections of the mine workings and the structure of the country in which the quartz bodies occur. (Plate XXV.)

[*Report sent in 23.11.07.*]

MINERAL SPRINGS AT DAYLESFORD.

By E. J. Dunn, F.G.S., Director, Geological Survey.

The springs dealt with are the Jubilee Lake Spring, Hard Hills Spring, Sutton's Spring, and Leggatt's Spring. The former is about 3 miles east of the town; the others are near the town, along the course of Wombat Creek as it flows southward from Daylesford.

Although they occur in a volcanic region, it is not certain that they owe their origin to volcanic sources, for it is clear that the mineral springs at Geelong, Ballan, near Blackwood, Daylesford, and to the south-west from Maldon are nearly on one line, and they may owe their origin to a fault line. Owing to their valuable curative properties and to their agreeable qualities as table waters, they are of great value to the town in attracting tourists, invalids, and others. Anything, therefore, which tends to restrict their flow, or otherwise to injure them, should be prevented if possible. It is generally accepted that these springs do not flow as freely as formerly and that the country around Daylesford has become much drier than in the first years of settlement. The disappearance of swampy ground and of small springs, and the diminution in the volume of the creeks is strongly marked, and in this respect the mineral springs exhibit a lesser volume of outflow than formerly in common with the lessened volume of water in ordinary springs and in the creeks.

When settlement began at Daylesford, the country was covered by a dense forest growth, many of the timber trees attaining to a great height. This has been removed to allow of the cultivation of the ground, for grazing purposes, for mine timber, for building purposes, and for fuel, and the forest has been drawn upon until the original growth has been entirely removed, and where there is any forest remaining it consists of an aftergrowth of saplings. The cutting of races and driving of tunnels have also helped to diminish the water supply.

The value of trees as a means of condensing moisture from the air is in proportion to the space they occupy in the atmosphere, and the present growth occupies but a fraction of what was occupied by the primeval forest. The inevitable result of removing the trees is that the country

becomes drier, and this has taken place and affected the mineral springs, as well as the other sources of water in the district. For, although the deepest source of the water in the mineral springs may be far down in the rocks, as the water approaches the surface the volume is added to by water derived from the surface, possibly in the vicinity of the mineral spring.

It appears that there are fluctuations in the flow of these springs dependent on the seasons, and this implies that at least a portion of their volume is controlled by the surface waters that are absorbed.

Unless the original conditions as regards the forest are restored, it is unlikely that the mineral springs will regain the volume of outflow that formerly prevailed. Although this would not be possible, something might be done in that direction by scrupulously preserving the forest growths on the reserves surrounding the mineral springs. Beyond this, it is difficult to see what could be done to increase the volume from them.

Another direction in which the outflow might be conserved is by refraining from impeding it. In opening out the eyes of the springs, care should be taken not to raise the height of the water above its natural level. In the case of some of these springs, the water has been raised 7 or 8 inches above the original level of outflow. This additional pressure diminishes the flow, and sometimes has a tendency to divert it into other channels. At the Jubilee Lake Spring, a cistern to hold 50 gallons of water was built over the eye of the spring, and the height of the outflow was raised, I am informed, about 8 inches. On my recent visit there was no outflow whatever from this spring.

These springs all come out of the rocks at the lowest points of the surface, generally in creek beds, and there is consequently a difficulty in so arranging their outflow that the water may be run into vessels. To accomplish this by raising the water-level in the spring is objectionable. The other method is to allow the water from the spring to flow through a pipe which is conducted a sufficient distance down the creek to allow of a vessel being placed below the outlet of the pipe.

In the case of both Hard Hills Spring and Sutton's Spring, it might be worth while to examine the eyes of the springs, and to ascertain that the outflow is at the natural level, and such action should be taken at the Jubilee Lake Spring as would restore the outflow to the natural level. It is not desirable in any way to attempt to enlarge, or in any other way to interfere with, the orifice of the springs.

At Leggett's Spring, after the rock around the eyes has been cleaned, and concrete walls have been built all around to exclude other water, the whole of the floor should be covered with concrete, except the eyes themselves, and these should be concreted around, and a small dome placed over them. The water should flow away from the two eyes at natural level, through tin-lined iron pipes, until sufficient fall is gained to allow of a vessel being placed under the outflow.

It is objectionable to accumulate the water in cisterns before using, as directly the water reaches the surface the gas escapes, and the salts go out of solution, and the qualities of the mineral water are lost. It is far better that the water should be drunk exactly as it leaves the spring. This being the case, it would greatly tend to increase the number of visitors if each spring had a handsome small pump-house built where the water is to be drunk, and if the surroundings were made pleasant by planting lawns or flower beds and by conserving or adding to the native trees near the springs and along the paths leading to them. When

it is considered how such springs in Europe have gathered cities around them, it is evident that some pains should be taken to render those existing in the State as valuable and attractive as possible.

In some cases, the alluvial deposits of clay, gravel, soil, &c., to the extent of several feet, have been stripped off the rocks near the springs; this facilitates the escape of gas, which may be seen escaping, in some cases, where a little water has accumulated. Where possible, some advantage might be gained by again covering the rocks with clay and then soil, which might be planted, the gas would then, perhaps, escape through the spring, instead of by other orifices.

[*Report sent in 20.5.09.*]

MOUNT FRANKLIN LEADS, NEAR DAYLESFORD.

By E. J. Dunn, F.G.S., Director, Geological Survey.

From Dry Diggings, near Daylesford, an alluvial gully has been worked for gold, and apparently with good results, in a north-westerly direction, and as far as the New Shakespeare shaft (145 feet deep) in allotment 3, section 9, Franklin parish; but the further extension of the lead has never been determined, either by boring or shaft sinking. There are two directions the lead may have followed. The one would be below the basalt flow, running in a north-westerly direction through Mr. Rees' property, and then on to Jim Crow Creek, where the basalt flow forms the bed of the creek from a little south of the Mill Spring. The basalt flow continues down the creek, forming its bed for several miles, and there should be a lead below the basalt at the bottom of the old valley. The other direction is through the west side of Mount Franklin, and then through the Mount Franklin estate, to where the Leviathan Mine was worked. The latter course appears to be favoured by the appearance of the washdirt obtained at the Leviathan shaft, which resembles the Shakespeare washdirt, and the degree of rounding of the gravel in the Leviathan workings implies that it had been subjected to more waterwear than if it had been derived from a local source. The probabilities are in favour of the lead having reached the Leviathan Mine from the Shakespeare shaft. Between the Leviathan workings and the tunnel mines near Franklingford, the basalt flow has not been mined under, and there is room for some boring.

The lead has been worked by tunnels below the basalt north-west from Franklingford.

Reverting to the flow of basalt that runs into and forms the bed of Jim Crow Creek just south of the Mill Spring (a perennial spring of excellent water and of large volume on the east bank of Jim Crow Creek), this flow is much lower than the basalt worked under by tunnels to the north-west of Franklingford, and it certainly marks the deepest watercourse that then existed. Further north, extensive mining has been carried on under it where the creek has deepened its course, but from the Mill Spring to beyond Franklingford the ground below the basalt does not appear to have been worked.

Mount Franklin..

This is one of the best examples of an old crater in the State. It is 5 miles due north of Daylesford, and the bottom of the crater is about 2,150 feet above sea-level. The crater is surrounded by a very regular circular rim, with a gap on the south-east side. On the north-west side

the rim is highest, and 300 feet above the floor of the crater. From this point it gradually falls on each side to the gap. In width, the rim is only a few feet on the top, with a steep descent on the inner side of the crater. There is about 6 acres of level ground surrounded by the rim. Grey vesicular basalt with some scoriaceous lava forms both the floor and the rim of the crater. Angular fragments of transparent oligoclase felspar and some small pieces of black glassy-looking mineral are met with on the rim and slopes, and occasionally a nodule of alivine. The rim of the crater is about 20 chains across. This volcano has broken through Ordovician slates and sandstones, and appears to have been active for a lengthened period from Newer Pliocene to perhaps Post Pliocene times. The lava flows have covered up auriferous drifts that were once in the beds of streams and water-courses. The basalt has been attacked by denuding agencies, and the drainage lines deepened to such an extent that these auriferous drifts have been worked extensively by levels and, in some cases, with much profit.

From Mt. Franklin and the adjacent points of eruption lava flows extended far down Jim Crow Creek. After much denudation there is still a continuous strip of basalt for 7 miles to the north-west of Mt. Franklin. The slopes of the crater are timbered.

[*Report sent in 4.11.07.*]

THE LORD TENNYSON REEF, WELSHMAN'S GULLY, EGANSTOWN, NEAR DAYLESFORD.

By A. M. Howitt.

The beds adjacent to the Lord Tennyson reef are Ordovician slates and sandstones, which strike N. 20 deg. W., and dip both east and west at angles varying from 60 deg. to 70 deg.

The reef is a lenticular laminated quartz block with an average width of 1 foot, bulging to 2 feet in width near the middle, and in strike it cuts the beds at a big angle.

Originally this reef was worked by a party holding the ground under lease, but the present holders are working under miners' rights.

From the surface to 95 feet deep the reef was payable and up to 30 feet in length, but water trouble caused the mine to close down.

Six months ago Osborne and party took up the ground, and decided to sink a new whim shaft 70 feet to the south of the old windlass shaft. This shaft they sunk 150 feet, timbered it closely in three partitions, and erected a whim, intending to cut the reef on its south pitch, and stope up to the old workings.

Their cross-cut at the 150-ft. level failed to cut the reef, and continuing on they passed through a slide to the east of where the reef should have been, so a rise was put up at 40 feet to the north-east of the shaft, and the reef found on the slide at a point about 30 feet above the 150-ft. level, thus allowing them very little of the reef to stope out.

The reef strikes W. 40 deg. N., underlies 70 deg. to the west, and pitches to the south-east at an angle of 60 deg. The slide strikes N. 1 deg. W., and dips 60 deg. to the east, so the intersecting angle of the reef and slide is about 30 deg., causing the appearance of a wedge where the reef cuts off to the south-east on the slide.

The beds which can be examined above the slide appear to dip 70 deg. to the west in the north-east cross-cut 15 feet from the rise, but where I could note them elsewhere they had a dip of 60 deg. to 70 deg. to the east.

Mr. Osborne informed me that in sinking the main shaft an anticlinal fold was cut at 120 feet deep, but the close timbering now obscures this from view, although an anticline should occur near the shaft as there are western beds in the gully to the west of the shaft.

The slide is strong, having black pug along it and crushed beds above, showing it has been the upper portion of the country which has moved on the lower. The direction of the movement cannot be definitely stated. but it is probably to the east, as a little quartz has been seen near the slide that way.

To the west of where the reef was lost the country has been already tested to some extent by a cross-cut; and the main shaft showed nothing below where the slide cut through it at 60 feet, but there is still a portion of the country to the west of the shaft of which nothing is known.

If, as seems probable, the lower portion of the reef lies to the east, then it will have to be looked for to the east of where the slide goes underfoot in the 150-ft. level, and this would necessitate further sinking of the main shaft, and cross-cutting out towards the slide again. This would be purely prospecting work, as no estimate can be formed of the amount of movement.

Whatever future work the party decide to carry out in trying to locate the reef, they must take carefully into consideration the westward dip of the reef, and particularly its pitch to the south. On account of its shortness this reef will be much harder to locate than if it had been in a better-defined channel extending for some distance.

Yields up to $2\frac{1}{4}$ ozs. to the ton have been obtained. and the two last crushings gave—

25 tons for 32 ozs. 15 dwts.
30 tons for 48 ozs. 7 dwts.

The present party have only earned about £11 per man for their six months' work, for after paying heavy expenses in putting up the whim and sinking a main regulation shaft there was little profit left from the crushings. At present the water can be kept down by a few hours baling with the tanks each day.

[*Report sent in 20.8.08.*]

THE ADMIRAL SPERRY REEF, NEAR ROCKY LEAD.

By W. H. Ferguson.

The Admiral Sperry reef, which has recently been found and prospected by Mr. W. Macane, of Wombat, is centrally situated between the townships of Wombat, Barkstead, and Rocky Lead. The strike is N. 17 deg. W., and the dip is to the west, at 75 deg. to 80 deg.; the reef agrees in both strike and dip with the country rock, which is Ordovician slates and sandstones. From this reef quartz leaders a few inches in thickness dip to the north-east at about 58 deg. and pitch to the north about 25 deg.; along the junction of these leaders with the vertical reef the latter appears to have been richer in gold. The reef has been worked on a pitch to the north to a depth of 35 feet; it varies in thickness from a few inches to 3 feet, which is now the thickness of

quartz showing in the northern face at the end of a short drive at the bottom of the mine. The shoot of gold, I am informed, has been worked almost continuously from the surface to the bottom of the mine, and varied from 12 feet to 15 feet in length. Mr. Macane, who has now sold the mine, obtained 20 ozs. of gold from it with only a small amount of work. There is only one wall showing in the mine, the hanging wall, which is well defined, and on it is a vein of laminated quartz; the rest of the quartz is white and rather vitreous, but colours of gold may be seen in quartz of this character. The stone crushed has yielded 1 oz. 2 dwts. of gold to the ton.

The most interesting feature of this reef is that it is associated with a dyke, which occurs on the eastern side of the reef channel. The dyke stone is now decomposed and soft, and light brown in colour, or in places red. It was nearest to the reef at the surface, and was not noted in the lower levels of the mine. The dyke was traced along the surface for 6 chains south of the shaft, and for 12 chains north of the shaft, and quartz—some of which is laminated—can be seen along the line of reef for quite this distance. The late owner of the mine did not recognise the dyke, but it will greatly facilitate prospecting operations along the surface, and should at any time the gold be lost in the mine, I would advise that it be looked for where this dyke is in, or close to, the reef channel.

The Wombat gold-field appears to resemble that of Maryborough, for the auriferous stone of both places is, in many instances, associated with the same class of basic dykes which are now decomposed at or near the surface to a soft rock which may be white, light or dark brown, or various shades of red in colour. On the Wombat field dykes occur with most of the reefs which have been inspected; this is a fact apparently overlooked, but most important for the prospector to remember when searching for new reefs or working old ones, and wherever a dyke of the character described is found at the surface it should be carefully prospected for auriferous quartz.

[*Report sent in 21.1.1909.*]

THE ALICE MAUD AND ARMAGH REEFS, BROOMFIELD, NEAR CRESWICK.

By W. Baragwanath.

The Armagh and Alice Maud Reefs, although two formations separated by a distance of about 1,000 feet east and west, may be considered as forming almost the extreme northerly outcrop of a belt of auriferous country which trends from here in a southerly direction past Creswick to Ballarat East, and is marked by outcrops of quartz and alluvial gold workings; the belt extends still further south, but for the present purpose only the northern end will be referred to. Alternate rich and poor portions exist throughout the length of the belt, over the greater part of which, although the alluvial therefrom was exceptionally rich, but little quartz mining has been carried on except at shallow levels.

The Armagh reef outcrops along the summit of a low spur which forms the eastern edge of the exposed bedrock in the neighbourhood of the Spring Hill basalts, which, on the immediate eastern fall, cover the once famous Western Lead of Allendale.

At time of my visit all workings on the Armagh reef were inaccessible, but Messrs. Williams and Young, who accompanied me over the ground, supplied me with the following data:—The reef was stoped to a depth of about 80 feet irregularly over a length of 700 or 800 feet, and the value of the stone was reported as fair quality.

In a shaft sunk to a depth of 100 feet by Williams and party, a make of stone passed under water level at 100 feet. Mr. Williams informed me that at that place the formation consisted of two walls, nearly vertical, 15 feet apart, with makes of quartz crossing from wall to wall and pitching to the north.

South of Williams' shaft (sunk about 30 years ago) a large shaft was noticed. Mr. E. J. Alexander, at present manager of the Guildford Deep Leads Company Limited, but formerly of this locality, informed me that this shaft was sunk to a depth of 150 feet in very hard country; but beyond cross-cutting to the lode above water level, in the neighbourhood of old workings, nothing further was done. Mr. Alexander informed me that the crushings from large bodies of stone yielded from 7 to 13 dwt. of gold to the ton.

Krausé, in his report on the Creswick field* states that the "Armagh reef is a lode from 2 to 6 feet thick at the outcrop, but diminishes in size downwards. The greatest depth to which the reef has been worked is less than 100 feet. It dips westwards at from 50 deg. to 75 deg. with the slate rock, while a number of veins, from 3 to 10 inches thick, dip easterly under low angles from 15 deg. to 30 deg. towards the main lode."

Mr. Alexander states that there were still large bodies of quartz left in the bottom of the old workings.

Owing to the subsidences near the old stopes, good dips could not be obtained. In the main shaft a section at the surface shows a dip of 60 deg. west. One feature of the strata from this shaft was its remarkable hardness, and even now, after 30 years' exposure, the slates still retain angular edges. Two probable causes suggest themselves as to the reason of this; one is that the strata has been indurated, and the other that faulting has brought into closer proximity to the surface strata which were formerly deeper.

The workings of the Alice Maud reef occur on a parallel ridge about 1,000 feet west of the Armagh line. Little work has been done on this line, which, in a section exposed in a gully to the north and pointed out to me by Mr. Williams, consists of a mass of crushed strata about 20 feet in width, and lying between hard sandstone country on either side. A shaft sunk on the crown of the hill is said to have reached a depth of 50 feet. About 30 years ago a patch of rich specimens was obtained near this shaft by a man named Bell. West of this line of reef the surface of the hill has been ploughed and sluiced, and rich yields have been reported.

There can be no doubt but that the alluvial shed from this belt of country has been exceptionally rich, and the northern extension of the line passes through the famous Madame Berry mine. As to the nature of the gold occurrence, very little information can be obtained, but, from the specimens reported, it appears as if the deposits partook of the nature of indicator veins, *i.e.*, smaller bodies of quartz in which concentration of gold values has occurred, while the larger portions of the reefs may be barren.

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* Prog. Rept. Geol. Surv., Vict., No. IV.

To prove whether this is so or not requires work below the surface. Such work could consist in, say, sinking the old Armagh shaft to a depth of 300 feet, and cross-cutting to and beyond the reef.

Similarly, the shaft on the Alice Maud line might be sunk to a depth of 100 feet, in order to determine the true nature of the reef formations.

[*Report sent in 25.3.07.*]

Further Report on the Alice Maud Mine, Broomfield.

The mine is situated about three-quarters of a mile to the south-east of the Broomfield Railway Station. Rich yields were obtained from surfacing, as mentioned in my report of April. At the time of my previous visit all the surface workings were closed, and no suggestion as to the origin of the rich alluvial gold was forthcoming. Subsequently, a local syndicate cleaned out a shaft in the immediate vicinity of where some of the richest specimens were obtained and found a vein of stone dipping westerly at a low angle and cutting through strata dipping to the east. An occasional colour of gold led the party to conclude that further west something payable would be found, so, with this object in view, they cleaned out and sunk to a total depth of 112 feet a shaft which had been sunk by a former party to a depth of 55 feet, at which depth the vein mentioned in workings detailed above, was cut. At about 90 feet from surface another vein, also dipping west, was cut, and 8 feet below this a larger one was passed through. Colours of gold and small specimens were found in both these veins, and on reaching water-level in the shaft a cross-cut was put in westerly to intersect both the above veins on their downward course. This, unfortunately, was not successful, but the cross-cut shows an interesting section from a geological point of view as affording an insight into a new feature in the structural arrangements of that portion of the field. Although the cross-cut is only 60 feet in length, three dykes, each distinct in appearance and almost vertical, were passed through; the strata on the eastern side of these intrusive masses have an easterly dip, and on the western side a westerly dip. (Fig. 31.)

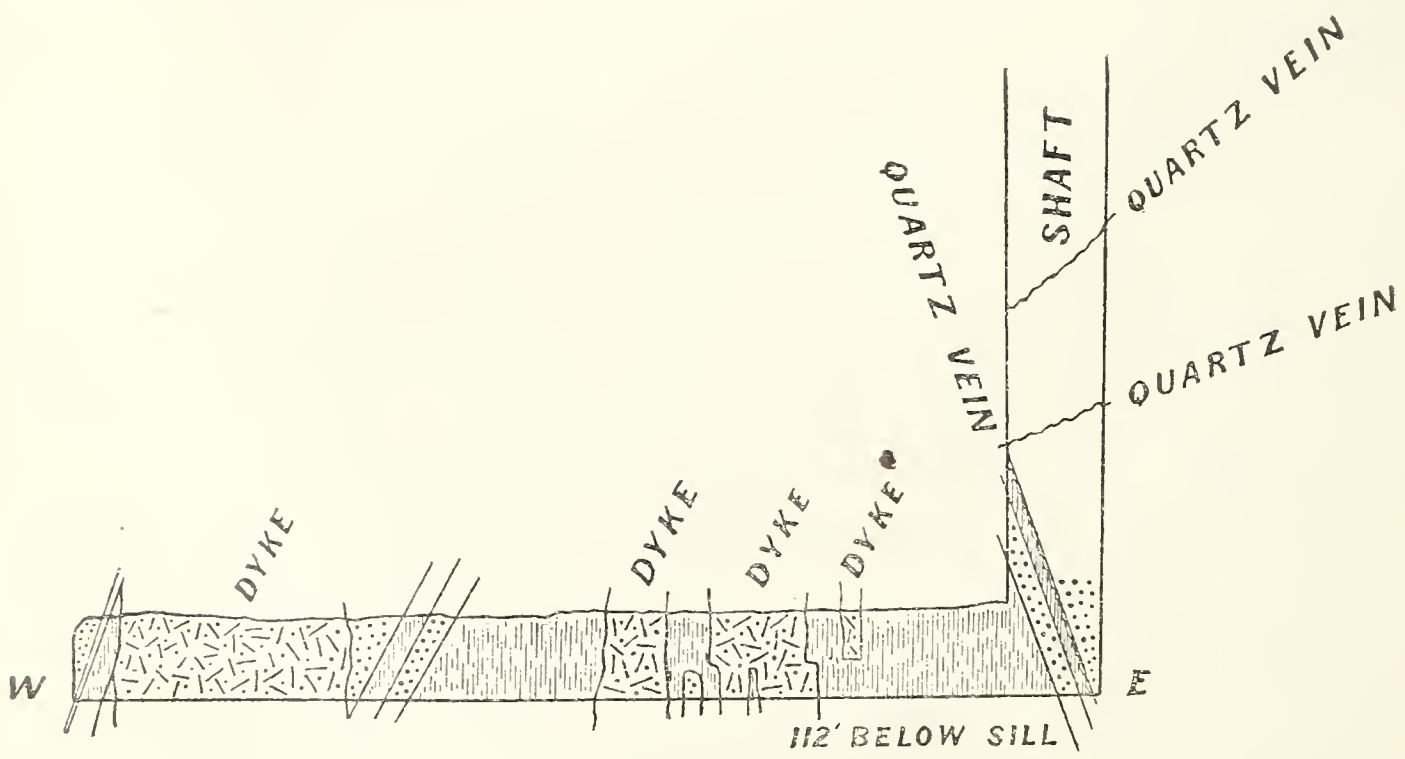

Figure No. 31

Transverse Section, Alice Maud Co.'s Crosscut Bloomfield.
Scale 20 ft. to 1 inch.

The most easterly dyke is much decomposed, and consists of a fine-grained, neutral-coloured ground mass, through which is scattered numerous felspar crystals, some of a pink colour. This dyke is 6 feet in width.

The second dyke somewhat resembles the above in colour, but has a great abundance of mica. It is quite probable that these two dykes represent slight differences from the same intrusion, and are probably referable to the lamprophyres or allied alkali rocks.

The third or most westerly dyke attains a width of 14 feet, and consists of a white decomposed matrix, through which scattered felspar crystals and more rarely small blebs of quartz occur. This dyke probably belongs to the quartz porphyry or felsite series. Scattered acicular rods up to $\frac{3}{16}$ inch in length probably represent what were originally crystals of hornblende. Joints intersect the mass in various directions, and along these joints a secondary product, of a greasy appearance, ranging up to an eighth of an inch in width occurs. This was identified as chloropal at the laboratory.

For a width of a couple of feet on either side of these dykes the strata are indurated, the slates breaking in small rectangular blocks.

Although from a practical point of view the results so far have not been successful, more light is now shown on the nature of the gold occurrence. It appears probable that the rich specimens and the rich alluvial obtained from the outcrop came from flat veins of quartz, of which some four or five are now exposed. I was shown a shallow cut where half-an-ounce of gold to the dish of dirt was obtained in the past, and this was in a belt of purple-coloured slates. This slate was identical in colour and appearance with that in which rich yields have been obtained in the shallow reef workings at Little Bendigo, near Ballarat. This slate might, therefore, be regarded as a favorable bed or indicator. From the shaft workings, &c., it appears that this belt of slate dips east, and, in my opinion, auriferous stone is most likely to be found at the intersection of quartz veins with this slate. The association of the veins and the dykes is not yet apparent, but it is quite likely that the felspar porphyry dyke is earlier than the reef, while the mica porphyrite is probably later. This assumption is based on observation of similar dykes—on apparently the same line of strike—to the west of Little Bendigo.

As to suggestions for future workings, it is advisable that the veins cut in the shaft be followed west to prove whether the dyke has or has not any beneficial effect upon them.

A cross-cut should be put out easterly from the bottom of the shaft for a distance of at least 100 feet. Any veins parallel to those already cut would then be intersected. On meeting the belt of purple slate, which probably at this depth would be found to be pyritous, a rise could be put up to prove if any veins passed through in cross-cut were auriferous.

[*Report sent in 15.11.07.*]

THE AGE OF THE ROCKS AT MARONG AND DUNOLLY.

By T. S. Hall, M.A., D.Sc., Melbourne University.

The Age of the Rocks at Marong.

In reply to the request of the Director of the Geological Survey that I should, if possible, fix more definitely the horizon of the rocks at Marong which yielded graptolites Nos. 1873-1900, I have the honour to state

that the evidence of the fossils is rather indefinite. The beds are certainly Bendigonian and not Castlemanian. Number 1900 is *Didymograptus nitidus*. This is common in the Castlemaine series, but is not found throughout the Bendigo series. How far down into the latter rocks it passes is as yet unknown, but its presence in the present collection is evidence that we are not dealing with the lowest members of the Bendigonian.

In such a small and imperfect collection of specimens, negative evidence is not of very great value, but as no "tuning-fork" graptolites are present, there is no sign that the uppermost Bendigonian is represented. I should not then feel justified in saying more than that the rocks are Bendigonian, but do not belong to the lowest members of the series.

[*Report sent in 5.9.07.*]

The Age of the Rocks About Dunolly.

The determination of the relative ages of rocks by means of fossils rests on so sure a foundation as to need no defence, and graptolites yield to no other group of organisms in the exactness with which they may be utilized for this purpose. Though not absolutely confined to Ordovician and Silurian rocks, they here attain their greatest profusion, both in numbers and in species, and the shortness of the range in time of many easily recognised forms enables us to determine with certainty the relative age of the containing rocks.

The graptolites of the central area of Bendigo have been fairly well studied, and we now know that rocks of the same age, or Bendigonian, occur in many other places in the State. The most characteristic fossils are *Tetragraptus fruticosus*, *Tetragraptus pendens*, and *Goniograptus thureaui*. *Tetragraptus approximatus* is shown by a study of this area to be characteristic of the lowest part of the Bendigo series, and to pass into the older rocks below, while *Tetragraptus serra*, *Tetragraptus bryonoides*, and *Phyllograptus typus* range throughout, but also pass up into the higher series of beds.

Below the Bendigo series is found a series of rocks which are best studied at Lancefield, and are hence called Lancefieldian. They are characterized by profusely and often irregularly branching graptolites, such as *Bryograptus victoriæ*, which seems to range up into the Bendigonian, though it is there extremely rare. Several species of *Clonograptus* occur, such as *C. flexilis*, *C. rigidus*, and *C. rigidus* var. *tenellus*. The gigantic *C. magnificus* is common at many localities, and passes up into Lower Bendigonian. *Dictyonema* is represented by two stoutly-built forms, *D. macgillivrayi* being the largest species known.

The district treated of more particularly in this report extends from Bendigo westward nearly to Bealiba, a distance of close upon 40 miles, and from near Maryborough northward to Inglewood, a distance of about 25 miles.

Scattered over this area are some forty localities from which graptolites have been obtained. The material for the most part has been in an extremely poor state of preservation, so that in a large number of cases it was not possible to determine the fossils; still, from most localities a sufficient number of identifications were made to fix the age of the beds approximately. Had the material been better it might have been possible to subdivide the rocks more closely and to add to our knowledge of the fauna of the period. But this could not be done.

The detailed lists from the various localities appear in other places in these Records, and we are now merely concerned with the results.

From a couple of miles east of Bealiba eastward to Laanecoorie the rocks appear to be entirely of Lancefieldian age. They have been proved on a north and south line along their strike, which is 5 or 10 deg. west of north, for about 15 miles. Doubtless it will be possible when our knowledge is greater to subdivide the series; but to do this will require better material, and this it does not seem possible at present to obtain, and this in spite of the skill and energy with which Mr. Ferguson has searched these most unpromising rocks. There is among the fossils a constant repetition of well-known Lancefield forms, and there was nothing which seemed to suggest the presence of species not known to occur at Lancefield itself. Still, better material may lead to a modification of this view.

About 15 miles north of the east and west Bendigo-Bealiba line we find, at Inglewood, slightly to the east of the Laanecoorie strike, that we have the first indication of a change. Two of the three fossils found are Lancefieldian, namely, *Tetragraptus decipiens* and *Clonograptus* sp., the latter suggesting a Lancefield species. The third fossil, of which there were half-a-dozen specimens, was *Tetragraptus approximatus*. This species has hitherto been found only in association with *T. fruticosus* and other Bendigo forms, as near Hustler's Reef at Bendigo itself, and near Dromana. Since the Inglewood find it has been discovered in the Parish of Clarendon associated with *Clonograptus rigidus* var. *tenellus* and *Tetragraptus fruticosus*. Undoubted Lancefieldian has been found not far to the south-east of the Clarendon locality.

We have, then, this interesting state of affairs:—*T. approximatus* is found at Inglewood associated with Lancefield forms alone, and at Clarendon with the Lancefieldian *C. rigidus* var. *tenellus* and the Bendigonian *T. fruticosus*, while at Bendigo and near Dromana its associates are apparently entirely Bendigonian. Its presence, then, may be taken to indicate, on the one hand, the top of the Lancefield, and, on the other, the base of the Bendigo, series, and the two series pass into one another without a break.

We have, then, on the Inglewood strike reached the summit of the Lancefieldian, and further eastward may expect to find higher rocks as we approach Bendigo. South from Inglewood, and on the same strike, we find at about 32 miles undoubted Bendigonian at the Loddon Valley Gold-fields mine. The species represented are *Tetragraptus quadribrachiatus*, *T. fruticosus*, and *Clonograptus* sp. Still further south, and on the same general strike, Campbelltown and Smeaton are also of Bendigonian age. It is, of course, quite possible that higher and lower series come in, but so far the only fossils found along this line are Bendigonian.

The southern extension of the Bealiba-Laanecoorie Lancefieldian belt is shown by the finding by Mr. A. M. Howitt, at Wareek, to the west of Maryborough, of a fine series of Lancefieldian fossils.

At Marong, 8 miles west of Bendigo, and in its immediate neighbourhood (Darook, Leichardt), we find undoubted Bendigonian. West of Marong a basalt flow hides most of the underlying rock, and possibly we may never know its age, but to the eastward, towards Bendigo, there is nothing to prevent fossils being searched for and found. We are, however, not in a state to say whether or not younger beds crop out at the surface between Marong and the central Bendigo area.

To sum up:—The age of the rocks about Dunolly, in the middle of the Bealiba-Laanecoorie belt, is Lancefieldian, then on the Inglewood-Campbelltown-Smeaton strike we reach the higher Bendigonian series. The eastward continuation of this, between Llanelly and Marong, is basalt-masked; but Bendigonian is again met with at Marong, and probably continues as far as Bendigo, and possibly still further to the eastward.

[*Report sent in 20.11.08.*]

REPORTS ON GRAPTOLITES.*

By T. S. Hall, M.A., D.Sc. (Melbourne University).

Sebastian.

From Sebastian. Mullock tip of the North Frederick the Great mine. Collected by Mr. E. J. Dunn (No. 5965), and the same locality collected by Mr. H. S. Whitelaw.—Nos. 5966-6016.

Didymograptus extensus.—No. 5992.

D. caduceus.—Nos. 5973, 5974, 5975, 5978, 5979, 5985, 5986, 5991, 5993, 5995, 5996, 5997, 6000, 6002, 6005, 6006, 6007, 6010, 6011, 6013, 6014.

D. sp.—No. 5987.

Tetragraptus serra.—Nos. 5976, 5977, 6002.

Goniograptus macer, T. S. Hall.—Nos. 6015, 6016 (counterparts).

Trigonograptus.—No. 5984.

Phyllopoda.—Nos. 5969, 5975, 5987, 5992, 5994, 5998, 6012.

Rest indeterminate.

Age, Castlemainian.

Bendigo.

From Lightning Hill Line, east of Great Extended Hustler's Mine, Bendigo. (Collected by E. O. Thiele, B.Sc.).

Tetragraptus approximatus, Nicholson.—No. 2763.

The relationship of the rocks containing *T. approximatus* to the rest of the Bendigo series needs determining in the field. The *approximatus* beds are probably near the base.

[*Report sent in 24.4.08.*]

From south of Specimen Hill race, Parish of Sandhurst. From S.M.B. boundary post, No. 19, S. 3 deg. 30 min. W. 1,785 links.—(Nos. 4182-4197. Collected by Mr. H. S. Whitelaw.)

Clonograptus magnificus.—4184.

Goniograptus thureaui, McCoy.—4183-4189, 4192, 4197(?).

Tetragraptus pendens.—4182-4186, 4190-4193, 4195, 4196.

Tetragraptus fruticosus.—4182, 4183, 4185, 4186, 4196.

Tetragraptus quadribrachiatus.—4188, 4190.

Didymograptus sp.—4182, 4190, 4192-4194, 4196, 4197.

The age is Bendigonian.

[*Report sent in 16.11.08.*]

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* Other Reports on Graptolites by Dr. Hall will be found in Vol I., Pts. 1, 3, 4. and Vol II., Pts. 1, 2, 4 of these *Records*.

From 500 feet S.E. of S.E. corner of Thistle lease, Kangaroo Gully, near the Langdon Mine.—(Nos. 4198-4223. Collected by Mr. H. S. Whitelaw.)

Tetragraptus fruticosus.—4198, 4203-4205, 4208-4212, 4218, 4223.
Tetragraptus pendens.—4200, 4202, 4205, 4222.
Tetragraptus bryonoides.—4200, 4206, 4209, 4222.
Tetragraptus serra.—4216.
Phyllograptus typus.—4207, 4216, 4220, 4222.
Didymograptus extensus.—4203(?), 4205(?).
Rest indeterminate.
Age.—Bendigonian.

[*Report sent in 16.11.08.*]

Bendigo.—Victoria Quartz Mine, from the surface.—(Nos. 4224-4272. Collected by Mr. H. S. Whitelaw.)

Tetragraptus fruticosus.—4225, 4228-4231, 4233, 4236(?), 4237, 4242, 4245, 4246, 4251, 4253, 4254(?), 4255, 4256, 4258, 4263, 4266, 4269.
Tetragraptus pendens.—4224, 4228.
Tetragraptus quadribrachiatus.—4255, 4272.
Tetragraptus serra.—4256.
Didymograptus extensus.—4227.
The remainder are indeterminate.
Age.—Bendigonian.

[*Report sent in 16.11.08.*]

Bendigo.—New Moon United Mine. About 300 feet below the surface.—(Nos. 4273-4284. Collected by Mr. H. S. Whitelaw.)

Clonograptus sp.—4273, 4278.
Tetragraptus serra, Brongn. (Syn. *T. amii* Elles and Wood).—4273, 4280.
Tetragraptus bryonoides.—4273, 4278, 4280.
Phyllograptus typus.—4274, 4276, 4279, 4281, 4282, 4284.
Rest indeterminate.
Age.—Bendigonian.

[*Report sent in 16.11.08.*]

Nos. 4573-4596.—New Prince of Wales Mine, Bendigo. (Collected by Mr. H. S. Whitelaw.)

Didymograptus sp.—Nos. 4576, 4584, 4587.
Tetragraptus fruticosus.—Nos. 4573-4585, 4587-4596.
T. quadribrachiatus.—Nos. 4577, 4586.
T. bryonoides.—Nos. 4579, 4592, 4596.
Phyllograptus typus.—Nos. 4576, 4579, 4582, 4584-4589, 4594, 4595.
Goniograptus macer, T.S.H.
The remainder are indeterminate.
Age, Bendigonian.

[*Report sent in 22.11.09.*]

Nos. 6086, 6087.—From Victoria Consols mine, Bendigo, No. 12 cross-cut, about 1,000 feet from the surface, 60 feet west of shaft. Collected by Mr. H. S. Whitelaw.

The specimens both contain numerous examples of *Tetragraptus fruticosus*, some three, but mostly four-branched forms. It is unusual for material from this depth to show signs of oxidation, but the fossils are rusty-coloured. The back of one specimen has a small thickness of slate chips and dust cemented to the slab by an incrustation of carbonate of lime, so that I think the oxidation has taken place since the "'cross-cut" was opened by the miners.

[*Report sent in 28.2.10.*]

CHEWTON.

From Chewton railway line, about 370 feet west of the Chewton station.—(Nos. 2720-2727. Collected by Mr. H. S. Whitelaw.)

Didymograptus bifidus, J. Hall.—Nos. 2720, 2721.

Tetragraptus serra, J. Hall.—No. 2721.

The remainder are indeterminate fragments.

[*Report sent in 17.3.08.*]

From the same locality, but about 385 feet west of Chewton station.—(Nos. 2728-2735. Collected by Mr. H. S. Whitelaw.)

Didymograptus bifidus, J. Hall.—Nos. 2729, 2730, 2734.

Phyllograptus typus, J. Hall.—Nos. 2732, 2733 (counterparts), 2735.

The remainder are indeterminate fragments. Age, Lower Castlemaine. The beds are probably an extension of those described by myself in Kampf's Gully, about half-a-mile to the south, the fossils and lithological character of the rocks being the same. It is doubtful if the two localities from which Mr. Whitelaw obtained these fossils can be separated.

[*Report sent in 17.3.08.*]

DUNOLLY.

From N.W. corner of Allotment No. F1 of 1, Parish of Dunolly E. 16 chains, then N. 35 deg. E. 22 chains.—(Nos. 3225-3350. Collected by Mr. W. H. Ferguson).

The specimens are preserved in very hard, brown, cleaved slate with an irregular fracture.

The following determinations have been made:—

Bryograptus victoriæ, T. S. Hall.—Nos. 3228, 3233, 3262 (?), 3289 (?), 3293 (?), 3294, 3308, 3309, 3312, 3319, 3334, 3339.

Bryograptus sp.—Nos. 3229, 3230, 3252, 3253, 3269 (?), 3270, 3275, 3277, 3279. 3286, 3292, 3295, 3301 (?), 3306, 3308, 3314 (?), 3318, 3320. 3349.

Clonograptus flexilis, J. Hall.—No. 3319.

Clonograptus rigidus, var. *tenellus*, Linnars.—Nos. 3250, 3255 (?), 3262. 3290 (?), 3302 (?), 3310, 3330, 3338.

Clonograptus magnificus, Pritchard.—Nos. 3225 (?), 3242, 3254, 3271 (?). 3308, 3319.

Clonograptus sp.—Nos. 3234, 3242, 3244. 3259, 3277, 3278 (?), 3288, 3313, 3320, 3336, 3342, 3345 (?), 3347 (?).

Tetragraptus decipiens, T. S. Hall.—Nos. 3227, 3237, 3285, 3343.
Dendrograptus sp.—Nos. 3337 (?), 3340 (?).
Dictyonema macgillivrayi, T. S. Hall.—3264 (?). Terminations of branches only. No dissepiments shown.
The remainder are indeterminate.
Age, Lancefieldian.

[*Report sent in 9.7.08.*]

BROMLEY.

Burnt Creek Mine, Bromley. From S.E. corner of Allotment No. 32 of 3, Parish of Dunolly W. 2 chains to waste heap of mine workings.—(Nos. 3351-3406. Collected by Mr. W. H. Ferguson).
The containing rock is a blue, earthy slate strongly cleaved at about 30 deg. to the bedding plane.
The following determinations were made:—
Bryograptus victoriæ, T. S. Hall.—Nos. 3361 (?), 3377, 3395 (?).
Bryograptus sp.—No. 3388.
Clonograptus rigidus, var. *tenellus*, Linnars.—Nos. 3357, 3378, 3402 (?).
Clonograptus magnificus, Pritchard.—Nos. 3358, 3378 (?).
Clonograptus flexilis, J. Hall.—Nos. 3351 (?), 3352 (?), 3370 (?), 3387 (?).
Clonograptus sp.—Nos. 3351, 3352, 3360 (?), 3364, 3368 (?), 3377, 3382, 3391, 3396 (?), 3404, 3406 (?).
Tetragraptus decipiens, T. S. Hall. — Nos. 3351, 3352, 3354, 3403 (?).
The remainder are very fragmentary for the most part, and all are indeterminate.
Age, Lancefieldian.

[*Report sent in 9.7.08.*]

PARISH OF BARP.

Nos. 3007-3013 from Barp are indeterminate.

From north-east corner of Allot. 41 of A., Parish of Barp.—(Nos. 3014-3039. Collected by Mr. W. H. Ferguson.)
Nos. 3017, 3020(?), 3024 are Phyllopoda.
Remainder indeterminate.
Age, doubtful.

[*Report sent in 28.4.08.*]

PARISH OF WAANYARRA.

From south-east corner of Allot. 14 of 10, Parish of Waanyarra.—(Nos. 3040-3089. Collected by Mr. W. H. Ferguson.)
Clonograptus rigidus, J. Hall.—Nos. 3054, 3065(?), 3069.
Clonograptus rigidus, var. *tenellus*, Linnars.—No. 3081.
Clonograptus magnificus, Pritchard.—No. 3087(?).
Clonograptus sp.—Nos. 3040(?), 3075, 3078, 3079(?), 3080, 3082, 3085(?), 3086(?), 3089(?).
Remainder indeterminate.
Age, Lancefieldian.

[*Report sent in 28.4.08.*]

From Ray's Luck Mine, S.W. corner of Janeville Pre-emptive Purchase, Parish of Waanyarra, N. 26 deg. E. 40 chains then S. 15 deg. E. 22 chains—(Nos. 3090-3224. Collected by Mr. W. H. Ferguson.)

The silvery looking graptolites are in a bluish-grey soft earthy slate, with very irregular fracture. They are badly preserved.

The following have been determined:—

Bryograptus victoriæ, T. S. Hall.—Nos. 3163 (?), juv., 3212 (?), 3220, 3222 (?).

Bryograptus sp. Nos. 3090 (?), 3161 (?), 3162 (?), 3197 (?), 3199 (?), 3213 (?).

Clonograptus flexilis, J. Hall.—Nos. 3103, 3119 (?), 3120 (?), 3173 (?), 3211.

Clonograptus rigidus, J. Hall, var. *typicus*.—Nos. 3092 (?), 3100 (?), 3156 (?), 3164 (?), 3186 (?), 3224.

Clonograptus rigidus, var. *tenellus*, Linnars.—No. 3201.

Clonograptus magnificus, Pritchard.—Nos. 3181 (?), 3222 (?).

Clonograptus spp.—Nos. 3090, 3113 (?), 3118, 3149 (?), 3202, 3204, 3210, 3215 (?).

Dendrograptus sp.—Nos. 3153, 3159 (?), 3195 (?), 3221.

Dendrograptus or *Bryograptus*.—Nos. 3114, 3202.

Tetragraptus decipiens, T. S. Hall.—No. 3215 (?).

Didymograptus pritchardi, T. S. Hall.—No. 3217 (?).

The remainder are indeterminate.

Age, Lancefieldian.

[*Report sent in 9.7.08.*]

Goldsborough.

From cutting on Goldsborough to Bealiba railway, east of Cramerri's siding half-a-mile west of Reid's cutting.—(Nos. 2765-2772. Collected by Mr. W. H. Ferguson.)

Bryograptus victoriae, T. S. Hall.—No. 2770(?).

Bryograptus or *Tetragraptus decipiens*.—No. 2766(?).

Clonograptus sp.—No. 2768(?).

Remainder indeterminate.

Age, apparently Lancefieldian.

[*Report sent in 28.4.08.*]

Bet Bet.

From Bet Bet, Oxonian Reef, 20 chains east from south-east corner of Allot. 59, Sec. III., Parish of Bet Bet.—(Nos. 2736-2746. Collected by Mr. W. H. Ferguson.)

Clonograptus rigidus, var. *tenellus*, Linnars.—Nos. 2739(?), 2743 (several), 2746.

The remainder are indeterminate, but the small lanceolate markings may be Phyllopods allied to *Rhinopterocaris*.

The rocks are Lancefieldian.

[*Report sent in 17.3.08.*]

Parish of Painswick.

From north-east corner of Allot. No. 18 of IX., Parish of Painswick.—(Nos. 2773-2798. Collected by Mr. W. H. Ferguson.)

Clonograptus sp.—2773(?), 2785(?), 2789(?).

Remainder indeterminate.

Age, apparently Lancefieldian.

[*Report sent in 28.4.08.*]

From north-east corner of Allot. No. 18, as above.—(Nos. 2799 2824 Collected by Mr. W. H. Ferguson.)

Clonograptus rigidus, var. *tenellus*, Linnarson.—No. 2805.

Nos. 2799, 2801, 2802, 2820, 2824 are dendrites.

No. 2811 is perhaps Algal.

Remainder indeterminate.

Age, apparently Lancefieldian.

[*Report sent in 28.4.08.*]

From north-east corner of Allot. 18, as above.—(Nos. 2825-2855. Collected by Mr. W. H. Ferguson.)

Clonograptus flexilis, J. Hall.—No. 2841.

Dictyonema macgillivrayi, T. S. Hall.—Nos. 2825(?), 2832, 2833, 2849, 2851.

Nos. 2825, 2840 are probably sponge spicules.

Nos. 2844, 2846, 2855 are dendrites.

Remainder indeterminate.

Age, Lancefieldian.

[*Report sent in 28.4.08.*]

From Gipsy Diggings, Allotment No. 6 of Section XI., Parish of Painswick. Collected by Mr. W. H. Ferguson.—Nos. 3408-3472.

The rock is a purple decomposed shale with the bedding only indistinctly shown. The supposed graptolites are branching threads about 0.5 mm. in diameter, and are surrounded by a red aureole. As they are not confined to one plane, but cross the bedding at varying angles they may represent annelid burrows; they certainly are not graptolites.

[*Report sent in 2.11.08.*]

Parish of Tarnagulla.

From south-west corner of Allot. 14A of A, Parish of Tarnagulla.—(Nos. 2856-3006. Collected by Mr. W. H. Ferguson.)

Clonograptus magnificus, Pritchard.—Nos. 2858(?), 2862(?), 2865(?), 2893(?), 2925, 2931, 2999(?).

Clonograptus rigidus, var. *tenellus*, Linnars.—Nos. 2856(?), 2867(?), 2890, 2897, 2922(?), 2954, 2968, 2889.

Clonograptus flexilis, J. Hall.—Nos. 2859(?), 2892(?), 2897.

Clonograptus sp.—2860(?), 2871, 2891, 2895, 2912, 2933(?), 2948(?), 2974, 2981, 2989, 2990(?), 2997, 2998.

Bryograptus sp.—2886(?), 2903, 2920, 2893.

Tetragraptus decipiens.—T. S. Hall.—Nos. 2856, 2860(?), 2866, 2874, 2880, 2888, 2889, 2916, 2919, 2930(?), 2960.

Tetragraptus sp.—Nos. 2868, 2873(?).

Phyllograptus sp.—No. 2959(?)
Didymograptus pritchardi, T. S. Hall.—No. 2908(?).
Dictyonema cf. *pulchellum*, T. S. Hall.—No. 2879.
Dictyonema sp.—No. 2921.
Dendrograptus sp.—No. 2932(?).
Phyllopoda.—Nos. 2857, 2868, 2869, 2875, 2877, 2899, 2915, 2916, 2931. 2949, 2963, 2987, 2988, 2991, 2993.
Remainder indeterminate.
Age, Lancefieldian.

[*Report sent in 28.4.08.*]

Prince of Wales and Poverty Reefs, Tarnagulla. Collected by Mr. W. H. Ferguson.—Nos. 3592-3654.
Bryograptus victoriæ, T. S. Hall.—Nos. 3614, 3621, 3628, 3641.
Bryograptus sp.—Nos. 3598 (?), 3601 (?), 3602.
Clonograptus magnificus, Pritchard.—Nos. 3595 (?), 3597 (?), 3616, 3617 (?), 3624 (?).
Clonograptus flexilis, J.Hall.—Nos. 3642 (?), 3643 (?), 3645 (?).
Clonograptus sp.—Nos. 3592, 3594, 3596, 3604, 3607 (?), 3620, 3627, 3633, 3633 (?).
Tetragraptus decipiens, T. S. Hall.—Nos. 3614, 3615.
The remainder are indeterminate, though most are graptolite fragments.
Age, Lancefieldian.

[*Report sent in 2.11.08.*]

Township of Tarnagulla. Collected by Mr. W. H. Ferguson.—Nos 3655-3714.
Bryograptus sp.—Nos. 3659 (?), 3661 (?), 3677, 3688, 3703 (?).
Clonograptus rigidus, J. Hall, var. *typicus*.—Nos. 3675 (almost certain), 3700.
Clonograptus rigidus, J. Hall, var. *tenellus*, Linnars.—No. 3686 (?).
Clonograptus sp.—Nos. 3668, 3677, 3691, 3704.
Tetragraptus decipiens, T. S. Hall.—Nos. 3657, 3662, 3664, 3671, 3076.
The rest are indeterminate.
Age, Lancefieldian.

[*Report sent in 2.11.08.*]

Tarnagulla, near Methodist Church. Collected by Mr. W. H. Ferguson.—Nos. 3715-3750..
Bryograptus sp.—Nos. 3718, 3723 (?), 3731, 3736.
Clonograptus sp.—Nos. 3722 (?), 3731, 3741 (?).
Tetragraptus decipiens.—Nos. 3715, 3727 (?), 3745.
Remainder indeterminate.
Age, Lancefieldian.

[*Report sent in 2.11.08.*]

Phœnix Mine, near Tarnagulla. Collected by Mr. W. H. Ferguson.—Nos. 3763-3770.
Clonograptus magnificus.—Nos. 3768 (?), 3770 (?).
The remainder are indeterminate.
Age, probably Lancefieldian.

[*Report sent in 2.11.08.*]

South end of Poverty Reef, Tarnagulla.—Nos. 3771, 3772.
The indeterminate talcose markings do not suggest graptolites.

Golden Fleece Reef, Elaine. Collected by Mr. A. M. Howitt.—Nos. 3774-3801, 3804.

Bryograptus victoriæ.—3776, 3782(?), 3783(?), 3785(?), 3794(?), 3797(?), 3798(?).
Bryograptus sp.—3775, 3781, 3785, 3788(?), 3790.
Clonograptus magnificus.—3779(?).
Clonograptus flexilis.—3775(?).
Clonograptus sp.—3781(?), 3785(?), 3790, 3796(?), 3799(?).
Tetragraptus decipiens.—3797(?).
Leptograptus antiquus, T. S. Hall.—3804.
Remainder indeterminate.
Age, Lancefieldian.

[*Report sent in 2.11.08.*]

LLANELLY.

From Sandstone Reef, Llanelly, near Llanelly Railway Station. Collected by Mr. W. H. Ferguson.—Nos. 3473-3591.

Bryograptus victoriæ, T. S. Hall.—Nos. 3529 (somewhat doubtful), 3569 (?).
Bryograptus sp.—Nos. 3480 (?), 3522, 3538, 3585 (?).
Clonograptus rigidus, J. Hall, var. *typicus*.—Nos. 3483 (?), 3523 (?).
Clonograptus rigidus, var. *tenellus*, Linnarson.—No. 3528 (?).
Clonograptus cf. *flexilis*, J. Hall.—3559.
Clonograptus sp.—Nos. 3481, 3520, 3490, 3537 (?), 3545 (?).
Tetragraptus decipiens, T. S. Hall.—3479, 3489, 3527, 3529, 3547, 3554, 3561 (?), 3580 (?).
Didymograptus pritchardi, T. S. Hall.—3570 (?).
Didymograptus sp.—3570 (?).
The remaining slabs nearly all show graptolites, but they are quite indeterminate.
Age, Lancefieldian.

[*Report sent in 2.11.08.*]

Cambrian Reef, Llanelly. Collected by Mr. W. H. Ferguson.—Nos. 3751-3762.

In none of these can I be sure of detecting any graptolites. The rock is crowded with small spherical nodules, probably due to metamorphism.

[*Report sent in 2.11.08.*]

INGLEWOOD.

Columbian Mine, Inglewood. From south-west corner of Allotment No. 7C, Parish of Salisbury West, W. 7 deg. N. 80 chains. Collected by Mr. W. H. Ferguson.—Nos. 3932-3982.

Clonograptus flexilis.—3932, 3962.
Clonograptus rigidus, var. *tenellus*.—3954, 3956(?), 3958(?), 3964.
Tetragraptus approximatus.—3932(?), 3939(?), 3952(?).
Tetragraptus decipiens.—3951(?), 3965.
Didymograptus sp.—3938.
The age will be discussed with that of the fossils from the next locality.

[*Report sent in 2.11.08.*]

Shenandoah Reef, Inglewood. From south-west corner of Allotment 7C, Parish of Salisbury West, W. 4 deg. N. 96 chains. Collected by Mr. W. H. Ferguson.—3983-4040.

Clonograptus sp.—3983.

Tetragraptus approximatus.—3984, 3999, 4012, 4020(?), 4032, 4039.

Tetragraptus decipiens.

The remainder are indeterminate.

Age, Lancefieldian, near the top of the series. The specimens of *Tetragraptus approximatus* are, several of them, large and undoubted, while it is almost certain that the imperfect specimens from the neighbouring locality, previously dealt with (Colombian Mine) are correctly identified.

There has been great uniformity in the fossils over all the country to the west of this locality and it is of great interest to find, as we approach the Bendigo district, that a fresh fossil puts in an appearance. The association of *T. approximatus* here with Lancefield forms and its occurrence near Hustler's Reef, Bendigo, in company with typical Bendigonian fossils, such as *T. fruticosus*, shows that it is characteristic of Upper Lancefieldian and Lower Bendigonian alike. It assumes, therefore, considerable value as a zone fossil. *T. approximatus* was first found in Victoria at Bulldog Creek, in the Mornington Peninsula, and the beds there are at the base of the Bendigonian. Mr. Ferguson's discovery at Inglewood is one of very great stratigraphical value.

[*Report sent in 2.11.08.*]

Wedderburn.

Wedderburn. Collected by Mr. O. A. L. Whitelaw.—4041-4048.

These specimens are extremely indistinct, and I am not satisfied that they are graptolites at all. Still, it is possible that they are, and, if so, they are apparently Diplograptidae, and probably Upper Ordovician. It is, I venture to suggest, worth while causing better material to be searched for at this locality.

[*Report sent in 2.11.08.*]

Moolort.

Loddon Valley Gold-fields Mine. Collected by Mr. E. J. Dunn.—3850-3863.

Clonograptus sp.—3851(?), 3852, 3857, 3860, 3861, 3862.

Tetragraptus quadribrachiatus, J. Hall.—3851, 3852.

Tetragraptus fruticosus, J. Hall.—3858, 3859.

Crustacean.—3855.

Age, Bendigonian.

[*Report sent in 2.11.08.*]

Deep Creek.

Nos. 4922-4940.—Road cutting near the village of Deep Creek (Field No. 3 E.G.). From the N.E. corner of Allot. 95, Section B, Parish of Bullarook. E. 24 deg. S. 3 chains to fossils in road cutting. Collected by Mr. W. H. Ferguson.

Tetragraptus decipiens.—No. 4927(?).

Clonograptus rigidus, var. *typicus*.—No. 4926(?).

C. rigidus var. *tenellus*.—Nos. 4929, 4932, 4935, 4939(?), 4940(?).

C. flexilis.—Nos. 4928(?). 4938(?), 4931(?), 4933(?).

C. sp.—No. 4937.

Dendrograptus.—No. 4924(?).

Specimens 4925 and 4934 are counterparts, and, though fragments, show morphological characters well.

The remainder are indeterminate.

Age, Lancefieldian.

[*Report sent in 22.11.09.*]

Nos. 4967-4999. From the Deep Creek (Field No. 5 E.G.). From S.W. corner of State school, Eganstown, Allot. 4, Section 11A, Parish of Wombat, S. 29 chains to fossils in creek. Collected by Mr. W. H. Ferguson.

Bryograptus victoriæ.—Nos. 4967, 4968, 4987, 4993, 4994(?).

Bryograptus sp.—Nos. 4975(?), 4978(?), 4981(?), 4983, 4992(?).

Tetragraptus decipiens.—No. 4978(?).

Clonograptus rigidus var. *tenellus.*—Nos. 4967, 4968.

C. sp.—Nos. 4972, 4973, 4986, 4996, 4999.

Dictyonema macgillivrayi, T. S. H.—Nos. 4970, 4977, 4990, 4991, 4997, 4998. These are all fragments of the same specimen, some being counterparts. The fossil is much distorted by pressure, the width of the branches and of the fenestræ being greatly reduced. The length of the fenestræ, however, agrees well with that found in typical specimens of *D. macgillivrayi*, and I have but little doubt that our fossil is that species.

The remainder are indeterminate.

Age, Lancefieldian.

[*Report sent in 22.11.09.*]

Nos. 5000-5084.—From the Deep Creek (Field No. 2 E.G.). From S.W. corner of State school, Allot. 4, Section 11A, Parish of Wombat, S. 19 chains. Collected by Mr. W. H. Ferguson.

Didymograptus pritchardi.—No. 5079(?)

Tetragraptus decipiens or ?T. quadribrachiatus.—Nos. 5013, 5014, 5016, 5024, 5028, 5037, 5041, 5043, 5050, 5054, 5063, 5067, 5089, 5071.

Bryograptus victoriæ.—No. 5074(?).

Bryograptus.—Nos. 5039(?), 5042(?), 5078(?).

Clonograptus magnificus(?).—Nos. 5002, 5025, 5039, 5075.

C. rigidus var. *tenellus.*—No. 5039(?).

Rest indeterminate.

Age, Lancefieldian.

[*Report sent in 22.11.09.*]

Nos. 5085-5095.—From the Deep Creek (Field No. 1 E.G.). From S.E. corner of Allot. No. 8, Section B, Parish of Bullarook, E. 30 deg. N. 6 chains to waste heap.

Didymograptus pritchardi.—No. 5091.

Clonograptus rigidus var. *tenellus.*

C. sp.—No. 5087(?).

Bryograptus sp.—No. 5089(?).

Tetragraptus decipiens.—No. 5092.

Phyllopod.—No. 5085.

Remainder indeterminate.

Age, Lancefieldian.

[*Report sent in 22.11.09.*]

Nos. 5096-5119.—Deep Creek (Field No. 6 E.G.). From the S.W. corner of State school, Eganstown, Allot. 4, Section 11A, Parish of Wombat, S. 27 deg. W. 11½ chains. Collected by Mr. W. H. Ferguson.

Didymograptus pritchardi.—No. 5100(?).

Tetragraptus decipiens.—Nos. 5099, 5107, 5114, 5116, 5117, 5118, 5119.

Bryograptus victoriæ.—Nos. 5097, 5100(?), 5102, 5112, 5113, 5116, 5118, 5119.

Bryograptus sp.—Nos. 5096(?), 5098, 5101(?), 5109.

Clonograptus rigidus var. *tenellus.*—Nos. 5104, 5118, 5119.

Rest indeterminate.

Age, Lancefieldian.

[*Report sent in 22.11.09.*]

Nos. 5120-5136.—From the Deep Creek (Field No. 8 E.G.). From S.W. corner of State school, Allot. 4, Section 11A, Parish of Wombat, S. 19 chains and then N.W. for 1 chain.

Clonograptus rigidus.—No. 5124.

C. flexilis.—No. 5136(?).

Bryograptus.—No. 5134.

Rest indeterminate.

Age, probably Lancefieldian.

[*Report sent in 22.11.09.*]

From Sailor Prince Extended tunnels, Deep Creek. From the N.W. corner of Allotment No. 126 of Section A, Parish of Bullarook, N. 42 deg. E. 15 chains, and then on a bearing of 12 deg. for 17 chains to tunnel (Field No. 51 R.L.). Collected by Mr. W. H. Ferguson. —Nos. 5884-5964.

Tetragraptus approximatus.—Nos. 5889, 5898, 5899, 5903, 5907, 5910, 5912, 5914, 5927, 5936, 5938, 5940, 5945, 5947, 5959, 5962, 5963.

T. serra.—Nos. 5887, 5888, 5893, 5894(?), 5895(?), 5902, 5904(?), 5930, 5939, 5956.

T. quadribrachiatus.—Nos. 5890(?), 5897, 5905, 5909, 5916, 5922, 5924, 5926, 5934, 5961(?).

T. fruticosus.—No. 5896(?).

Rest indeterminate.

Age, Lower Bendigonian.

[*Report sent in 18.2.09.*]

Daylesford.

Nos. 4828-4921.—New Mineral Spring, Daylesford. No. 4828 collected by Mr. E. J. Dunn, the remainder by Mr. W. H. Ferguson.

Didymograptus murchisoni.—Nos. 4833(?), 4840(?).

D. pritchardi.—No. 4834.

D. extensus.—Nos. 4835, 4838, 4849, 4850, 4858, 4897, 4921.

D. sp.—Nos. 4859, 4861, 4873, 4875, 4893.

Tetragraptus fruticosus.—Nos. 4828, 4829, 4831-4835, 4838, 4839, 4841-4852, 4854-4860, 4862, 4864-4867, 4869-4871, 4873-4877, 4880-4884, 4886-4888, 4890-4892, 4894-4897, 4900-4905, 4908, 4909, 4911-4913, 4916, 4921.

T. bryonoides.—Nos. 4831, 4835, 4842, 4850, 4853, 4860, 4867, 4879, 4884, 4890, 4893, 4907.

T. serra.—Nos. 4836, 4848, 4862, 4873.

T. quadribrachiatus.—Nos. 4828, 4832, 4842, 4875.

Phyllograptus typus.—Nos. 4837, 4839, 4845-4851, 4856, 4858, 4860-4862, 4864, 4867, 4873, 4881, 4882, 4884, 4885, 4887, 4890, 4891, 4894, 4903, 4904, 4907, 4908, 4910, 4912, 4914, 4921.

Dichograptus octobrachiatus.—Nos. 4854 (with disc), 4859 (with disc).

Dichograptus sp.—Nos. 4832, 4882(?), 4887.

Clonograptus abnormis, J. Hall.—No. 4870.

Clonograptus sp.—Nos. 4862, 4898.

Goniograptus sp.—No. 4862.

Phyllopod.—No. 4910.

Rest indeterminate.

Age, Bendigonian.

[*Report sent in 22.11.09.*]

EGANSTOWN.

Nos. 4941-4966.—North of Eganstown (Field No. 4 E.G.). From N.E. corner of Allot, 22A, Section 11A, Parish of Wombat, N. 20 deg. E. 25 chains to shaft on alluvial mine. Collected by Mr. W. H. Ferguson.

With the exception of three or four slabs, which contain nothing determinable, all show specimens of Phyllopoda.

Age, doubtful.

[*Report sent in 22.11.09.*]

PARISH OF BULLAROOK.

From Graves United Mine.—From the N.E. corner of Allotment No. 105 of Section B, Parish of Bullarook, W. 30 deg. N. 22 chains to Graves United shaft (Field No. 27 R.L.). Collected by Mr. W. H. Ferguson.—Nos. 5480-5506.

Clonograptus sp.—No. 5488(?).

Dictyonema macgillivrayi.—Nos. 5485, 5495.

Rest indeterminate.

Age, Lancefieldian.

[*Report sent in 16.2.09.*]

From South Fraser's Mine.—From the N.E. corner of Allotment No. 105 of Section B, Parish of Bullarook, W. 20 deg. N. 5 chains to the South Fraser's Mine (Field No. 28 R.L.). Collected by Mr. W. H. Ferguson.—Nos. 5507-5563.

Tetragraptus quadribrachiatus or *T. decipiens.*—Nos. 5523, 5543, 5562(?).

Clonograptus sp.—Nos. 5520(?), 5522(?), 5542(?), 5547(?), 5562(?).

Bryograptus victoriæ.—No. 5530.

Phyllopoda.—Nos. 5509, 5513, 5515, 5520, 5524, 5528, 5533, 5537, 5541, 5549, 5559, 5560, 5563.

Rest indeterminate.

Age, probably Lancefieldian.

[*Report sent in 16.2.09.*]

Wombat.

From Grey Mare Reef.—From the N.E. corner of the Wombat Station Yard, Parish of Korweinguboora, N. 34 deg. E. 34 chains to Grey Mare whim shaft (Field No. 24 R.L.). Collected by Mr. W. H. Ferguson.—Nos. 5289-5376.

Tetragraptus decipiens.—Nos. 5289, 5290, 5299, 5306(?), 5312, 5324, 5330, 5340, 5352, 5358, 5364, 5367, 5370, 5374, 5376.

T. fruticosus.—No. 5355(?).

Clonograptus magnificus.—Nos. 5291, 5311(?), 5356(?).

C. rigidus var. *tenellus.*—Nos. 5309(?), 5325(?), 5365(?).

C. sp., indet.—No. 5371.

Bryograptus victoriæ.—Nos. 5296, 5309(?).

Bryograptus sp.—Nos. 5297(?), 5314(?), 5351(?), 5366(?).

Dictyonema sp.—Nos. 5304(?), 5305(?).

Phyllopoda.—Nos. 5294, 5301, 5310, 5313, 5329, 5331, 5332, 5334, 5337, 5338, 5341, 5344, 5347, 5373.

Remainder indeterminate.

Horizon.—The beds appear to belong to either the upper part of the Lancefieldian or the lower part of the Bendigonian. The presence of the specimen doubtfully referred to *T. fruticosus* would favour the latter reference, but in either case the absence of *T. approximatus* is remarkable.

[*Report sent in 16.2.09.*]

From Wombat Railway Cutting. S.W. corner of Wombat Station Yard, Parish of Korweinguboora (Field No. 32 R.L.). Collected by Mr. W. H. Ferguson.—Nos. 5699-5746.

Clonograptus rigidus, var. *tenellus.*—No. 3739 (?).

Clonograptus sp.—5699 (?).

Dictyonema macgillivrayi.—Nos. 5713, 5730.

Phyllopoda.—No. 5707(?).

Rest indeterminate.

Age, Lancefieldian.

[*Report sent in 16.2.09.*]

From Railway Cutting, S.W. corner of Wombat Station Yard, Parish of Korweinguboora (Field No. 33 R.L.). Collected by Mr. W. H. Ferguson.—Nos. 5747-5812.

Tetragraptus decipiens.—Nos. 5754, 5770, 5781, 5790, 5793(?), 5797 (?), 5800.

Clonograptus rigidus, var. *tenellus.*—Nos. 5750 (?), 5751, 5754, 5756, 5765, 5767, 5774, 5781, 5784, 5787, 5794, 5798, 5802, 5804, 5807.

Clonograptus sp.—No. 5748.

Bryograptus sp.—Nos. 5749 (?), 5782 (?).

Phyllopoda.—Nos. 5754, 5780, 5787, 5805.

Rest indeterminate.

Age, Lancefieldian.

[*Report sent in 16.2.09.*]

Rocky Lead and Parish of Dean.

Nos. 4423-4489.—Welsh and Slater Mine, Rocky Lead (Field No. R.L. 1.) From N.E. corner of Allotment 2F, Parish of Dean, N. 49 deg. W. 321 links to shaft. Collected by Mr. W. H. Ferguson.

Didymograptus sp.—No. 4428.

Tetragraptus fruticosus, J. Hall.—Nos. 4429, 4431, 4443, 4461, 4464.

Tetragraptus serra, J. Hall.—No. 4451.

Tetragraptus quadribrachiatus, J. Hall.—Nos. 4460, 4464.

Clonograptus sp.—No. 4474.

Phyllopoda.—Nos. 4458, 4478.

With the exception of some sponge spicules, the remainder are indeterminate.

Age, Bendigonian. *Phyllograptus* is not represented, so that the horizon is low, but as *Tet. approximatus* is not present it is not at the base of the series.

[*Report sent in 22.11.09.*]

Nos. 4609-4690.—Rocky Lead. From S.E. corner of Allotment No. 10 of Section 8, Parish of Dean, E. 4 deg. N. 14 chains to old shaft on the Welsh and Slater North Reef. Collected by Mr. W. H. Ferguson.

Didymograptus spp.—Nos. 4620, 4626, 4631, 4644, 4655, 4675, 4628, 4629, 4638, 4645, 4647, 4660, 4668, 4690.

Tetragr. fruticosus.—Nos. 4609, 4610 (?), 4615, 4616, 4651.

T. approximatus.—Nos. 4611, 4612, 4618, 4648.

T. quadribrachiatus.—Nos. 4612, 4653, 4678 (?).

T. bryonoides.—No. 4615.

T. pendens.—Nos. 4627, 4655, 4661, 4677, 4687, 4689 (?).

Clonograptus sp.—4656 (?), 4679.

Trichograptus fergusoni, n. sp.—Nos. 4615 (Type), 4642 (Type), 4650 (counterpart of 4615), 4657.

(For description see below.)

Remainder indeterminate.

Age, Lower Bendigo.

[*Report sent in 22.11.09.*]

Nos. 4691-4827.—Rocky Lead. From S.W. corner of No. 36 of X, Parish of Dean, N. 9 deg. E. 5 chains. Collected by Mr. W. H. Ferguson.

Didymograptus sp.—Nos. 4696, 4722, 4724, 4728, 4732, 4744, 4756, 4789, 4800, 4802, 4807, 4812, 4817, 4821.

Tetragraptus quadribrachiatus.—Nos. 4691, 4692, 4697, 4700, 4709, 4710, 4714, 4715, 4725, 4729, 4731, 4737(?), 4742, 4743, 4746, 4747, 4748, 4754, 4758, 4760(?), 4761, 4784, 4788, 4802, 4803, 4804(?), 4814, 4817, 4819.

T. fruticosus.—No. 4694.

T. approximatus.—Nos. 4701, 4704, 4734, 4762, 4777.

T. bryonoides.—No. 4817.

In addition 37 slabs contain Phyllopoda.

Remainder indeterminate.

Age, Lower Bendigo.

[*Report sent in 22.11.09.*]

From Rocky Lead Creek, at tunnel driven north. From the angle between roads bearing N. 19 deg. 48 min. W. and N. 0 deg. 52 min. W., Allotment No. 2, Section 12, Parish of Dean, N. 10 deg. W. 8 chains to tunnel (Field No. 42 R.L.). Collected by Mr. W. H. Ferguson.—Nos. 5813-5844.

Tetragraptus quadribrachiatus.—Nos. 5822, 5825, 5834.

Clonograptus sp.—Nos. 5818, 5838.

Dictyonema macgillivrayi.—No. 5816.

Phyllopoda.—No. 5814, 5839.

Rest indeterminate.

Age, Lancefieldian.

[*Report sent in 16.2.09.*]

Nos. 4490-4572.—Welsh and Slater Mine North. From S.E. corner of Allotment 1E of VII., Parish of Dean, W. 19 deg. N. 700 links, then W. 12 deg. N. 800 links to shaft (Field No. R.L. 2). Collected by Mr. W. H. Ferguson.

Didymograptus sp.—Nos. 4492, 4502, 4503, 4506, 4507, 4521, 4539, 4540, 4548, 4565, 4568.

Tetragraptus fruticosus.—This species is present on 23 slabs.

T. quadribrachiatus.—Present on 20 slabs.

T. approximatus.—Nos. 4499, 4549, 4543, 4562, 4566, 4569.

T. serra.—No. 4524.

Clonograptus flexilis.—Nos. 4505 (?), 4511 (?), 4516 (?).

Clonograptus sp.—Nos. 4531, 4539, 4549, 4561

Phyllopoda. — Nos. 4492, 4493, 4494, 4496, 4500, 4519, 4546, 4547, 4548.

A large number of specimens are indeterminate.

Age, Bendigonian. The absence of Phyllograptus suggests a low horizon, and this the presence of *T. approximatus* confirms. It may further be noted that at this locality, and at the one just recorded previously, most, but not all, of the specimens of *Tet. fruticosus* are four branched. The four armed variety seems to be characteristic of the lower beds of the Bendigonian.

[*Report sent in 22.11.09.*]

Nos. 5137-5163.—From shaft on the Rocky Lead at the Hall (Field No. 6 R.L.) From S.W. corner of Allot. No. 14, Section XI., Parish of Dean, N. 5 deg. E. 4 chains to shaft.

Tetragraptus decipiens.—Nos. 5150(?), 5154(?).

T. approximatus.—Nos. 5139, 5140, 5149.

Clonograptus rigidus var. *tenellus.*—Nos. 5156(?), 5161.

Rest indeterminate.

Age, probably Upper Lancefieldian.

[*Report sent in 22.11.09.*]

Nos. 5164-5228.—From the Try Again tunnel (Field No. R.L.). From the S.E. corner of Allot. No. 3 of Section XIII., Parish of Dean, S.E. 56 chains to tunnel.

Tetragraptus decipiens.—Nos. 5187, 5212, 5214.

Clonograptus rigidus var. *tenellus.*—Nos. 5166, 5172, 5180, 5184, 5190, 5194, 5195, 5198, 5210, 5209, 5212(?), 5220, 5225.

C. magnificus.—Nos. 5207(?), 5212(?).

Dictyonema macgillivrayi.—No. 5213(?).

D. pulchellum.—No. 5227 (?).
D. sp.—No. 5210(?).
Phyllopoda.—Nos. 5164, 5168, 5170, 5184, 5186(?).
Rest indeterminate.
Age, Lancefieldian.

[*Report sent in 22.11.09.*]

Nos. 5229-5288.—From the William Tell Reef, South workings (Field No. 23 R.L.). From the S.E. corner of Allot. 3, Section XIII., Parish of Dean E. 31 chains, then S. 2 chains to reef workings.

Tetragraptus decipiens.—Nos. 5232, 5250, 5266, 5285.
Clonograptus rigidus var. *tenellus.*—Nos. 5233, 5237, 5245, 5246, 5250, 5279, 5282(?).
C. sp.—Nos. 5251(?), 5277.
Bryograptus victoriæ.—No. 5273(?).
B. sp.—Nos. 5238(?), 5240(?), 5261(?).
Phyllopoda.—Nos. 5236, 5237, 5243, 5247, 5270, 5271, 5286, 5287.
Rest indeterminate.
Age, Lancefieldian.

[*Report sent in 22.11.09.*]

From William Tell Reef Main Shaft.—From the S.E. corner of Allotment No. 3 of Section XIII., Parish of Dean, E. 31 chains to main shaft (Field No. 26 R.L.). Collected by Mr. W. H. Ferguson.—Nos. 5438-5479.

Leptograptus antiquus, T. S. Hall.—No. 5443(?).
Tetragraptus decipiens.—Nos. 5438, 5459.
Bryograptus clarkei, T. S. Hall.—Nos. 5442, 5446, 5452, 5478(?).
Bryograptus victoriæ.—No. 5375 (?—young).
Bryograptus sp.—Nos. 5451(?), 5453(?), 5460(?), 5463(?), 5468(?).
Clonograptus rigidus var. *tenellus.*—Nos. 5457, 5477(?).
Clonograptus sp.—No. 5479(?).
Phyllopoda.—No. 5470.
Rest indeterminate.
Age, Lancefieldian.

[*Report sent in 16.2.09.*]

Parish of Korweinguboora.

From Queen of the Forest Reef.—From the N.W. corner of the State School allotment at Barkstead, Parish of Korweinguboora, W. 15 deg. N. 45 chains to whim shaft (Field No. 25 R.L.). Collected by Mr. W. H. Ferguson.—Nos. 5377-5437.

Tetragraptus decipiens.—Nos. 5397(?), 5416.
Clonograptus rigidus var. *tenellus.*—Nos. 5420, 5434.
Dictyonema macgillivrayi.—Nos. 5377, 5380, 5381, 5385, 5386, 5388(?), 5389(?), 5390, 5391, 5393, 5415, 5417, 5425, 5437.
Rest indeterminate.
Age, Lancefieldian.
Most, if not all, of the specimens of *Dictyonema* are parts of the same colony.

[*Report sent in 16.2.09.*]

From Scotty's Creek. From the S.W. corner of Allot. No. 4 of Section D (Warren's), Parish of Korweinguboora, S. 40 chains to whim shaft (Field No. 29 R.L.). Collected by Mr. W. H. Ferguson.—Nos. 5564-5583.

Tetragraptus quadribrachiatus or *T. decipiens*.—Nos. 5564, 5570, 5574, 5575, 5577, 5580.

Clonograptus rigidus, var. *tenellus*.—No. 5568 (?).

Phyllopoda.—Nos. 5576, 5582, 5583.

Rest indeterminate.

Age, probably Lancefieldian.

[*Report sent in 16.2.09.*]

Parish of Bullarook.

From Phœnix Mine. From the N.W. corner of Allot. No. 114 of Section XIV., Parish of Bullarook, W. 40 deg. S. 17 chains to shaft (Field No. 30 R.L.). Collected by Mr. W. H. Ferguson.—Nos. 5584-5612.

Didymograptus sp.—No. 5595.

Tetragraptus decipiens.—No. 5604.

Clonograptus rigidus, var. *tenellus*.—No. 5596(?).

Clonograptus sp.—Nos. 5588 (?), 5603 (?).

Bryograptus sp.—Nos. 5592 (?), 5593.

Dictyonema macgillivrayi.—No. 5602.

Rest indeterminate.

Age, Lancefieldian.

[*Report sent in 16.2.09.*]

Hepburn Rocky Lead Mine. From the S.W. corner of Allot. No. 12 of Section B, Parish of Bullarook, N. 23 chains to waste-heap (Field No. 31 R.L.). Collected by Mr. W. H. Ferguson.—Nos. 5613-5698.

Didymograptus spp.—Nos. 5624, 5641, 5686, 5630, 5633.

Tetragraptus fruticosus.—Nos. 5613 (?), 5619, 5631, 5635, 5643 (?), 5645 (?), 5653, 5672, 5680 (?), 5682, 5689, 5690, 5692.

T. pendens.—Nos. 5652, 5670, 5685, 5691, 5697, 5698.

T. decipiens.—Nos. 5621, 5624, 5683(?), 5695.

Clonograptus rigidus, var. *tenellus*.—Nos. 5637, 5649, 5655, 5668.

Trichograptus fergusoni, T. S. Hall.—Nos. 5619, 5621, 5632, 5637, 5655, 5683 (?), 5695.

Rest indeterminate.

Age, Bendigonian, fairly low horizon.

[*Report sent in 16.2.09.*]

Parish of Creswick.

From Dean-Creswick Road, Adekate Creek. From S.E corner of allotment which is between Allotments Nos. X5 and X6, Parish of Creswick, W. 41 deg. N. 1130 links to cutting (Field No. 50 R.L.). Collected by Mr. W. H. Ferguson.—Nos. 5845-5883.

Tetragraptus approximatus.—Nos. 5849, 5863, 5870, 5879.

T. quadribrachiatus.—Nos. 5850, 5852, 5856, 5859, 5865, 5869, 5872, 5875, 5876.

T. serra.—Nos. 5857, 5869, 5874, 5875, 5877.
T. bryonoides.—No. 5861.
Bryograptus sp.—No. 5868(?).
Rest indeterminate.
Age, Lower Bendigonian. The absence apparently of *T. fruticosus* is noteworthy.

[*Report sent in 16.2.09.*]

PARISH OF SMEATON.

Smeaton.—From south-east corner of Allot. No. 20 of section A, parish of Smeaton, N. 20 deg. W. 14 chains, in Hepburn's Home Paddock.—Nos. 4049 to 4119. Collected by Mr. W. H. Ferguson.
Clonograptus sp.—4098(?).
Dichograptus octobrachiatus.—4099.
Dichograptus sp.—4056, 4060, 4111.
Tetragraptus fruticosus.—4049-4053, 4055, 4057, 4059, 4061, 4063, 4065, 4067, 4069, 4071, 4073, 4075, 4077, 4079, 4083, 4087, 4103, 4104, 4112.
Tetragraptus bryonoides.—4061, 4075, 4089, 4106.
Tetragraptus serra.—4062.
Tetragraptus quadribrachiatus.—4050, 4112.
Tetragraptus sp. indet.—4085, 4095.
Phyllograptus typus.—4066, 4070(?), 4072(?), 4080(?), 4097(?), 4100.
Didymograptus extensus.—4049(?), 4055(?), 4061(?).
Didymograptus sp.—4058, 4071, 4074, 4091, 4107.
Phyllopod crustacea.—4064, 4086, 4096, 4104.
The remaining specimens are indeterminate.
The age of the beds is Bendigonian.

[*Report sent in 16.11.08.*]

BALLARAT DISTRICT.

Ballarat District.—Collected by Mr. W. H. Ferguson.—Nos. 4120-4181.
From Lady Mary Mine, Ballarat East, Allot. 7C, Sec. 27, parish of Buninyong.—Nos. 4120-4153.
Phyllopod crustacea.—4120, 4126, 4127, 4131, 4136(?), 4151.
Sponge spicules.—4121, 4133, 4142(?).

[*Report sent in 16.11.08.*]

From Bonshaw Mine, parish of Yarrowee.—Nos. 4154-4159.
Phyllopod crustacea.—4154, 4157(?), 4159(?).
Brachiopod.—4158.

[*Report sent in 16.11.08.*]

From New Imperial Mine, Black Lead, N.E. corner of cemetery, parish of Buninyong.—Nos. 4160-4162.
Graptolite.—4162(?).
Rest indeterminate.

[*Report sent in 16.11.08.*]

From Winter's Freehold, No. 2 Mine, Sebastopol.—Nos. 4163-4169.
Phyllopod crustacea.—4163, 4165-4169.
4164 is indeterminate.

[*Report sent in 16.11.08.*]

From Winter's Freehold, No. 1 Mine, Sebastopol.—Nos. 4170-4172.
Phyllopod crustacea.—4170.
Sponge spicules, long and straight.—4171(?), 4172(?).
Of the specimens from the remaining localities, Nos. 4173-4175 are phyllopod crustacea, while the rest are indeterminate.

These 61 specimens from the Ballarat district are what I picked out from a large collection made by Mr. Ferguson, in the hope that on closer examination they would afford some reliable data for determining the age of the rocks. I think from the Phyllopods, which appear to resemble those of known Ordovician age from elsewhere in Victoria, that the horizon is probably Lower Ordovician, but do not care to go further.

[*Report sent in 16.11.08.*]

From the most southern corner of Allot. 19B, of Section 11, parish of Clarendon, N. 35 deg. W. 4 chains.—Nos. 4357-4411.—Collected by Mr. W. H. Ferguson.

Clonograptus rigidus var. *tenellus*.—4359.
Bryograptus sp.—4376, 4408.
Tetragraptus decipiens.—4358, 4366, 4372, 4377, 4393, 4394, 4397, 4411.
Tetragraptus fruticosus.—4382, 4387.
Tetragraptus approximatus.—4360 (?), 4373(?), 4380, 4389.
Tetragraptus sp., juv.—4370, 4398.
Didymograptus sp.—4391.

There is a very large number of Phyllopods present on the slabs, which may repay further investigation.

This collection is of some importance, as we have associated for the first time *Clonograptus rigidus* var. *tenellus* and *Tetragraptus fruticosus*, the one characteristic of Lancefieldian, and the other of Bendigonian. *Tetragraptus approximatus* is associated with Lancefieldian forms at Inglewood, and with Bendigonian at Hustler's Reef, Bendigo, and near Dromana. We are then, at these places, apparently on the border line of the two great subdivisions, which form a continuous series.

[*Report sent in 16.11.08.*]

ELAINE.

Yorkshire Reef, Elaine. Collected by Mr. A. M. Howitt.—3802, 3803, 3805-3849.

Bryograptus victoriæ.—3808, 3826(?), 3836 (?), 3840(?), 3842(?). 3849(?).
Bryograptus sp.—3807(?), 3815(?), 3841(?).
Clonograptus flexilis.—3830(?), 3837, 3848.
Clonograptus rigidus, var. *tenellus*.—3831(?).
Clonograptus sp.—3802(?), 3819, 3821(?), 3824(?), 3828.
Didymograptus pritchardi.—3840(?).
Age, Lancefieldian.

[*Report sent in 2.11.08.*]

Elaine*.—From the most eastern corner of Allot. No. 48 (A. Munro), town of Elaine, parish of Borhoneyghurk, N. 20 deg. E. 8 chains.—Nos. 4285-4306.—Collected by Mr. W. H. Ferguson.

Clonograptus rigidus var. *tenellus*.—4302, 4287, 4288, 4289, 4295.

Clonograptus magnificus.—4287(?), 4289, 4291, 4306(?).

Clonograptus flexilis.—4305.

Clonograptus sp.—4301, 4304.

Bryograptus sp.—4300(?), 4303(?).

Tetragraptus decipiens.—4285, 4286, 4287, 4289, 4294, 4296, 4298(?), 4299, 4302.

Phyllopod.—4292.

Rest indeterminate.

Age.—Lancefieldian.

[*Report sent in 16.11.08.*]

Elaine.—From the same starting point, E. 16 chains.—Nos. 4307-4322.—Collected by Mr. W. H. Ferguson.

Clonograptus rigidus var. *tenellus*.—4307(?), 4319.

Clonograptus flexilis.—4309, 4317(?), 4318(?).

Clonograptus sp.—4322.

Bryograptus victoriæ.—4308, 4313.

Bryograptus sp.—4319(?), 4322(?).

Rest indeterminate.

Age.—Lancefieldian.

[*Report sent in 16.11.08.*]

Elaine.—From same starting point, E. 35 deg. S. 17 chains.—Nos. 4323-4346.—Collected by Mr. W. H. Ferguson.

There are two doubtful specimens of *Clonograptus magnificus*, and several of *Clonograptus* fragments, which are specifically indeterminate.

Age.—Probably Lancefieldian.

[*Report sent in 16.11.08.*]

Elaine.—From same starting point, E. 35 deg. S. 7 chains.—Nos. 4347-4350.—Collected by Mr. W. H. Ferguson.

Clonograptus rigidus var. *tenellus*.—4347, 4350(?).

Bryograptus sp.—4349(?).

Phyllopod.—4348.

Age.—Lancefieldian.

Elaine.—Nos. 4351-4353 are indeterminate.

[*Report sent in 16.11.08.*]

Elaine.†—From N.E. corner of Allot. 48, parish of Borhoneyghurk, town of Elaine, N. 10 deg. W. 46 chains.—Nos. 4354-4355.—Collected by Mr. W. H. Ferguson.

Clonograptus sp.—4355.

Tetragraptus decipiens.—4354.

Age.—Probably Lancefieldian.

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* Nos. 4285-4350 come from the same locality as Nos. 3802, 3803, 3805-3849, Yorkshire Reef, Elaine.

† Nos. 4354-4356 come from the same locality as Nos. 3774-3801, 3804, Golden Fleece Reef, Elaine

From N.E. corner of Allot. 48, go 356 deg. for 48 chains.—No. 4356. —Collected by Mr. W. H. Ferguson.

Clonograptus rigidus var. *tenellus*.—4356(?).

Rest indeterminate.

Age.—Apparently Lancefieldian.

[*Report sent in 16.11.08.*]

WOODEND.

From Woodend (Braemar golf-links).—(Nos. 2525-2535. Collected by Mr. D. J. Mahony, M.Sc.)

Phyllograptus typus, J. Hall.—Nos. 2526, 2527 (counterparts), 2531, 2532(?).

Diplograptus sp.—Nos. 2526, 2527 (counterparts), 2529, 2530 (counterparts), 2534.

Climacograptus sp.—No. 2528(?).

The remainder are indeterminate. The altered character of the rock renders identification difficult. The beds are Lower Ordovician, and are probably of the same age as those displayed a few miles to the westward and about four miles west of Gisborne. The exact horizon is doubtful, but I think it is near the middle of the Castlemaine series.

[*Report sent in 17.3 08.*]

MANSFIELD.

From Flannery's allotment, Mansfield. (Collected by Hon. D. Melville, M.P.).—Nos. 2747 (765), 2748 (766), 2749 (767), 2750 (771).

Dictyonema sp. Nos. 2747 (765), 2748 (766), 2749 (767). Unidentifiable No. 2750 (771).

The genus *Dictyonema* has a very wide range, and its species are too imperfectly known to allow of the identification of horizons by their aid. Besides this, the present specimens are too imperfect for determination. The genus is said to range from Lower Devonian to Upper Cambrian.

[*Report sent in 23.3.08.*]

KEVINGTON DISTRICT.

From Williams' Cutting, Goulburn River. Collected by Mr. O. A. L. Whitelaw.—Nos. 6017-6023.

The markings are not organic.

From Boundary Hill, on spur between Edwards and Snake Creeks. Collected by Mr. O. A. L. Whitelaw.—Nos. 6024-6064.

Leptograptus sp.—No. 6024(?).

Glossograptus sp.—Nos. 6024, 6025, 6028(?), 6032(?), 6034, 6039, 6041, 6057, 6062.

Diplograptidæ.—Nos. 6024, 6026, 6032, 6042, 6051, 6054, 6062.

Dicellograptus.—No. 6035(?).

Rest indeterminate.

It is very probable that the fragmentary stipes are those of Dicranograptidæ. As regards the other genera, *Glossograptus* and the Diplograptidæ are both Upper and Lower Ordovician. If, however, Dicranograptidæ occur, the beds are Upper Ordovician.

From Star of the West Mine, Kevington.—No. 6074.

The specimen is indeterminate, and may not be a graptolite.

[*Report sent in 16.12.09.*]

Myrtleford.

Nos. 4597-4608.—Myrtleford. From 10 chains N.E. of Allotment 2 (W. Clemens), Parish of Myrtleford. Collected by Mr. J. Easton.

These specimens show only fragments up to about half-an-inch in length of what appear to be Dichograptidæ. I was unable to identify any specimens. Possibly the beds belong to the upper part of the Lower Ordovician.

[*Report sent in 22.11.09.*]

Nowa Nowa.

Nowa Nowa. Five miles 50 chains from Nowa Nowa on road cut by Mines Department from Nowa Nowa to Buchan-road. Collected by Mr. O. A. L. Whitelaw.—3868-3931.

Didymograptus cf. *caduceus*, Salter.—3895.

Dichograptid fragments.—3868(?), 3876, 3879(?), 3880, 3883, 3888, 3889, 3916.

Dicranograptid fragments.—3893, 3910.

Diplograptus angustifolius, J. Hall.—3890(?), 3896(?), 3911(?).

Diplograptus sp.—3878, 3889, 3908, 3927, 3929.

Diplograptid.—3870, 3871, 3884, 3885, 3886, 3904, 3919, 3922, 3926(?), 3931(?).

Climacograptus sp.—3877, 3883, 3887, 3898.

Glossograptus hermani, T. S. Hall.—3869, 3872, 3874, 3881, 3888, 3891(?), 3893, 3895, 3900, 3901, 3903(?), 3912, 3914, 3917, 3918, 3928.

Glossograptus sp.—3873(?), 3879(?), 3894(?), 3899, 3909, 3921, 3930(?).

Clathrograptus geinitzianus, J. Hall.—3882, 3893, 3895, 3907, 3923.

Nos. 3920, 3929 show Brachiopods.

Age, Upper Ordovician. The exact horizon is uncertain, but lower than the Wellington River series and those of the Jordan-Thomson Rivers. The relative abundance of *Glossograptus* is remarkable.

[*Report sent in 2.11.08.*]

Mt. Wellington District.

Wellington River. Collected by Mr. A. B. Peden.—3865-3867.

Leptograptus flaccidus, J. Hall.—3865(?), 3866.

Diplograptus sp.—3865, 3867.

Climacograptus sp.—3865, 3867.

Age, Upper Ordovician.

Leptograptus flaccidus is a new record from the Wellington River beds, but the locality given is very vague.

[*Report sent in 2.11.08.*]

From four localities near the Serpentine Area, Mt. Wellington District.—Nos. 4414-4417. Collected by Mr. A. B. Peden.

Dicellograptus morrisi.—No. 4414 (?).

Dicellograptus gurleyi, Lapw.—No. 4415 (?).

Nemagraptus gracilis and ? *Dicellogr. morrisi*.—No. 4416.

Climacograptus bicornis.—No. 4417.

After very careful study, I am unable to absolutely identify the species of *Dicellograptus*. No thecæ are preserved sufficiently well to enable their shape and number to be decided. The provisional identifications are therefore based upon the form of the hydrosomes, which is quite unsafe for exact work. *Nemagraptus gracilis* is new for the

locality, and hitherto has been known only from near Diggers' Rest. There is a chance that with several creeks cutting across the strike of the rocks differences in the fauna may be traced, but it is not much use collecting promiscuously over miles of country.

[*Report sent in 25.11.08.*]

Accommodation Creek.

From Accommodation Creek Copper Mine, East Gippsland. Collected by Mr. E. A. Tonner.—Nos. 4418-4422.

Dicranograptus hians, T. S. H.—No. 4422.
Climacograptus caudatus, Lap.—Nos. 4418, 4420.
Cryptograptus tricornis, Carr.—No. 4421.
Diplograptus calcaratus, Lap.—No. 4421.
This specimen is well preserved, and has four basal spines.
The age of the rocks is Upper Ordovician.

[*Report sent in 22.12.08.*]

Descriptions of Species.

Trichograptus fergusoni, n. sp.

Pl. XXVI., Figs. 1, 2.

Hydrosome slender. bilaterally symmetrical, consisting of two main branches inclined at about 150 deg. Each of these gives off two or three secondary branches on the same side of the branch. These secondary branches appear to spring from the thecal aperture.

Sicula long and narrow with a very oblique aperture. It is 1.5 mm. long, and about 0.3 mm. wide. Thecæ 6 or 7 in 10 mm., inclined at about 15 deg., and scarcely. if at all, overlapping, slightly expanding. the apertural magin about normal to the axis of the branch.

The species is closely allied to *T. crinitus*, Tornquist*, but differs in the number of thecæ and their angle of inclination.

I have two specimens before me. one preserved in counterpart. The species is associated with *Tet. fruticosus* (four-armed variety), *T. bryonoides*, and some indistinct tangled specimens with similar thecæ, but different mode of branching. Nos. 4615, 4650, 4642, from the Lower Bendigonian, Rocky Lead.

The species is named after Mr. W. H. Ferguson, of the Geological Survey, whose skilled collecting has added so much to the knowledge of Victorian graptolites.

Dichograptus octobrachiatus, J. Hall.

Pl. XXVI., Fig. 3.

An imperfect specimen from the Bendigonian of Daylesford (4854) shows the central disc.

Clonograptus abnormis, J. Hall.

Pl. XXVI., Fig. 4.

(*See* Can. Org. Rem., Dec. II., 1865, p. 106, Pl. 11, Fig. 6.)

The specimen (4870) agrees closely with Hall's figure and description. Primary branches 4 mm. long, secondary about 1.3 mm. the tertiary varying from 2 to 4.5 mm. Thecæ, 10 in 1 cm. Bendigonian, Daylesford.

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* Lunds Univ. Arsskrift, Bd. 40, Afd. 1, No. 2 (1904), p. 4.

PLATE XXVI.

FIGS. 1, 2.—Trichograptus fergusoni n.sp. Nos. 4615 & 4650.

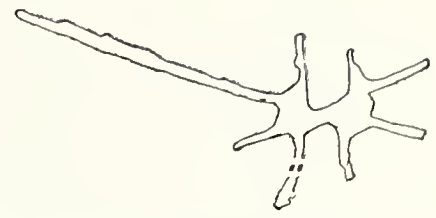

FIG. 3.—Dichograptus octobrachiatus, J. Hall. No. 4854.

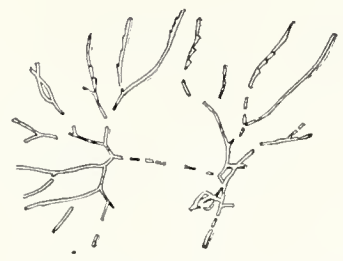

FIG. 4.—Clonograptus abnormis, J. Hall. No. 4870.

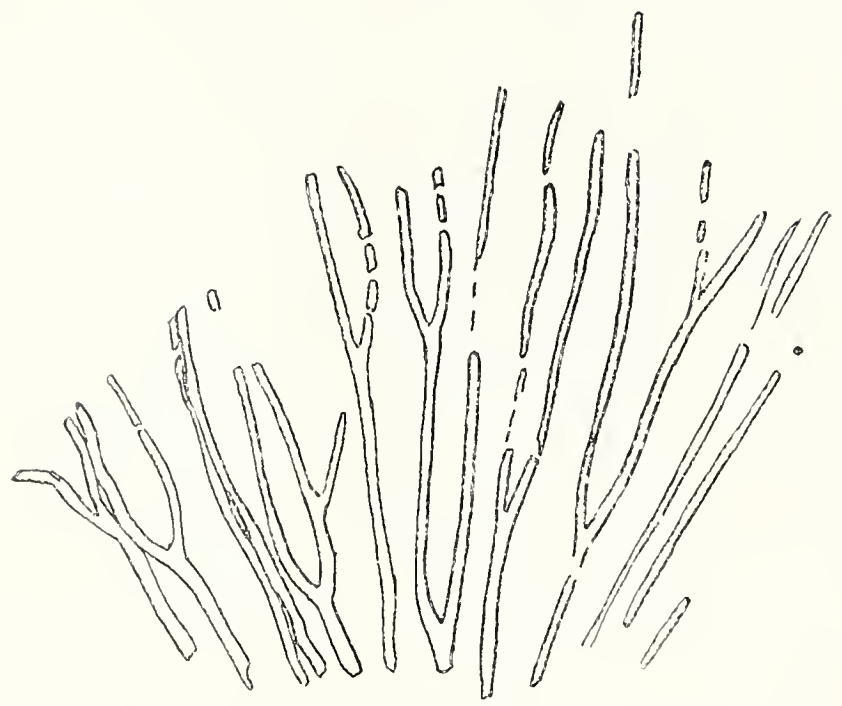

FIG. 5.—Clonograptus sp. No. 4999.

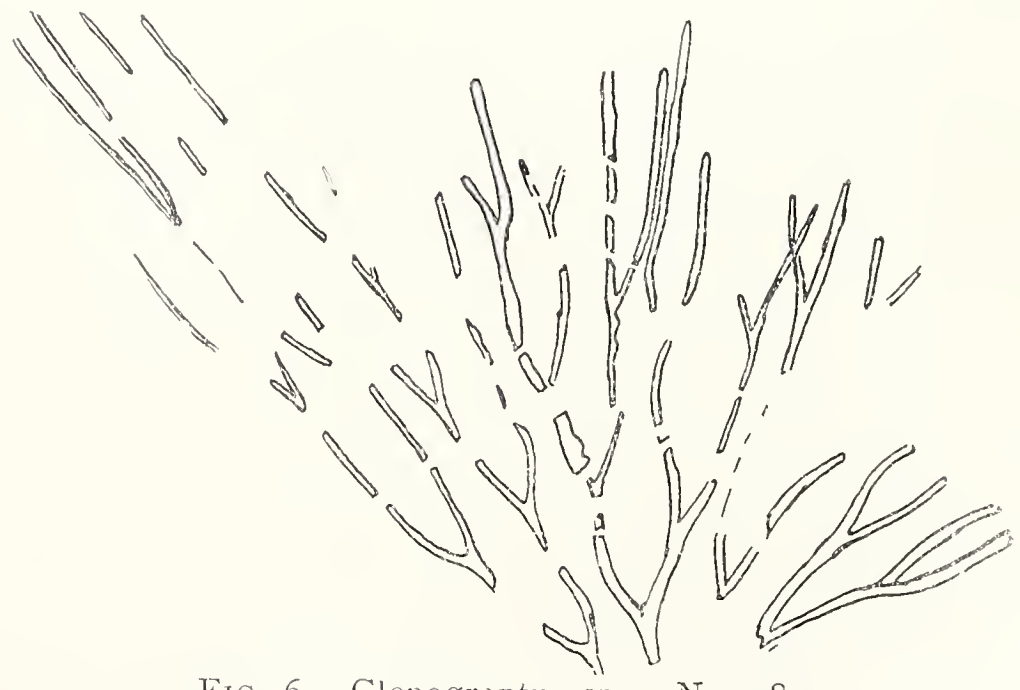

FIG. 6.—Clonograptus sp. No. 1845.

LOWER ORDOVICIAN GRAPTOLITES FROM DAYLESFORD, ROCKY LEAD, EGANSTOWN, AND WAREEK.

About natural size.

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Clonograptus sp.

Pl. XXVI., Figs. 5, 6.

An imperfect fragment from Wareek (1485) and another from Eganstown (4999) are figured. They are probably the same species. The beds are Lancefieldian.

Explanation of Plate XXVI.

1. Trichograptus fergusoni, n. sp. (4615) from Rocky Lead.
2. Trichograptus fergusoni, n. sp. (4650) from Rocky Lead.
3. Dichograptus octobrachiatus, J. Hall (4854) from Daylesford, showing central disc.
4. Clonograptus abnormis, J. Hall (4870) from Daylesford.
5. Clonograptus sp. (1485) from Wareek.
6. Clonograptus sp. (4999) from Eganstown.

[*Report sent in 22.11.09.*]

REPORT ON A COLLECTION OF LOWER ORDOVICIAN FOSSILS. (With 2 Plates.)

By Fredk. Chapman, A.L.S., &c., Palæontologist to the National Museum.

Parish of Wareek. Allot 2. Coll. by Mr. A. M. Howitt.

Nos. 2324-2332 and 2338, 2346 and 2357.—L. Ordovician slates with *Clonograptus*, and circular decomposition patches (?)inorganic.

Parish of Marong. Sect. XI., Allot. 4. Coll. by Mr. H. W. Ford.

No. 2404.—*Caryocaris marri*, Hicks and *C. wrighti*, Salter. (See Appendix). Also graptolites, det. by Dr. Hall.

Parish of Marong. Sect. IX., Allot. 8. Coll. by Mr. H. W. Ford.

No. 2413.—Fossil fragments, indet.

Nos. 2419-21.—*Caryocaris* sp.

Parish of Marong. Wilson's Reef Shaft, Block 4, Village of Darook. Coll. by Mr. H. W. Ford.

No. 2435.—Carbonaceous stains, probably due to the remains of Crustacea.

Nos. 2450, 2455.—(?)Crustacea, indet. Graptolites (det. by Dr Hall).

Parish of Marong. Sect. XI., Allot 4. Coll. by Mr. W. H. Ford.

Nos. 1892, 1895, 1896.—Crustacean remains, indet.

Parish of Marong. Sect. IX., Allot 8. Coll. by Mr. W. H. Ford.

No. 1903.—Crustacean remains, indet.

Parish of Franklin. Sect. VIII., Allot. 2. Coll. by Mr. G. Birch.

Nos. 1901, 1908, 1935, 1937, 1939.—*Rhinopterocaris maccoyi*, Eth. fil. sp.

Nos. 1902, 1904, 1911, 1938.—Crustacean fragments, indet.

No. 1923.—Graptolites.

No. 1940.—Phyllocarids, indet.

Spring Creek, North of Hepburn. Coll. by Mr. W. Baragwanath.

No. 1907.—Graptolites only.

No. 1912.—Phyllocarid remains.

1917.—cf. *Caryocaris*.

1934. *Caryocaris* and *Rhinopterocaris*.

Junction of Spring and Jim Crow Creeks, Parish of Franklin. Coll. by Mr. W. Baragwanath.

Nos. 1905, 1915.—cf. *Rhinopterocaris*.

No. 1931.—Graptolites only.

Jim Crow Creek, 18 chains north-west of Bryce's Bridge, Parish of Franklin. Coll. by Mr. W. Baragwanath.

Nos. 1910, 1924.—Phyllocarid remains, indet.

No. 1926.—*Rhinopterocaris maccoyi*, Eth fil. sp.

Jim Crow Creek, west of Hepburn. Coll. by Mr. W. Baragwanath.

No. 1920.—*Rhinopterocaris*, carapaces of. Also impressions of a large phyllocarid, indet.

No. 1930. *Rhinopterocaris* and other phyllocarids (casts of the carapaces).

No. 1933.—(?)*Hymenocaris hepburnensis*, sp. nov. (See Appendix.) Also *Rhinopterocaris*.

Hepburn. Junction of Spring and Jim Crow Creeks. Nos. 1466-78; 1498-1511. Coll. by Messrs. Baragwanath and Birch.

Nos. 1466, 1472.—cf. *Rhinopterocaris*.

Nos. 1467-1469, 1471, 1473-1478, 1498-1501, 1503, 1505-1511.—Casts and impressions of crustacea, indet.

No. 1470.—(?)*Hymenocaris hepburnensis*, sp. nov. (See Appendix.)

No. 1502.—Phyllocarid remains, indet.

No. 1504.—Casts of (?)*Hymenocaris hepburnensis*, sp. nov.

Notes on the Phyllocarids.

Remarks on *Caryocaris*, from Marong. Plate XXVII.

The two species of *Caryocaris*, *C. wrighti* and *C. marri*, which are characteristic of the Upper Arenig beds (Skiddaw Slates) in England, occur here on the same slab, No. 2404, of Lower Ordovician slate, in company with *Tetragraptus fruticosus*. I have already identified the two species above-named, on the fractured surface of a glacial erratic derived from a L. Ordovician indurated slate from Wynyard, Tasmania[1]. Prof. Rupert Jones and Dr. H. Woodward also note the frequent association of these two forms on the same slab in the rocks of Keswick, and offer the opinion that "It is possible that the two forms show sexual differences."[2]

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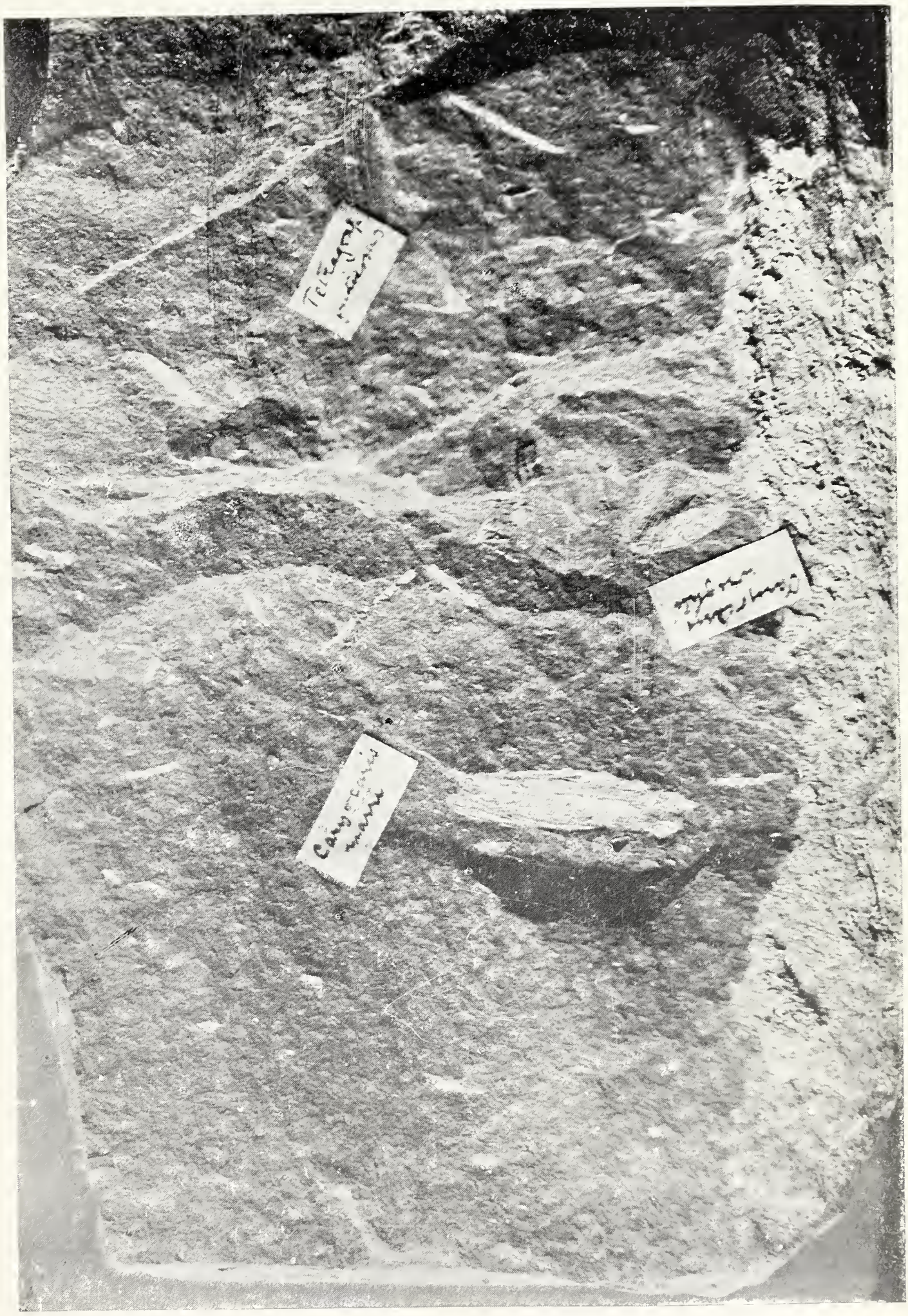
1. Rep. Aust. Assoc. Adv. Sci., 1908 (1907), p. 281, Pl. XIV., Figs. 2–6.
2. Brit. Pal Phyllopoda, Pal. Soc. Mon: 1892, p. 92.

Plate XXVII.



F.C., photo.

SLAB OF LOWER ORDOVICIAN SHALE [NO. 2404], WITH CARYOCARIS MARRI AND C. WRIGHTI.

About natural size.

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PLATE XXVIII.

FIG. 1.

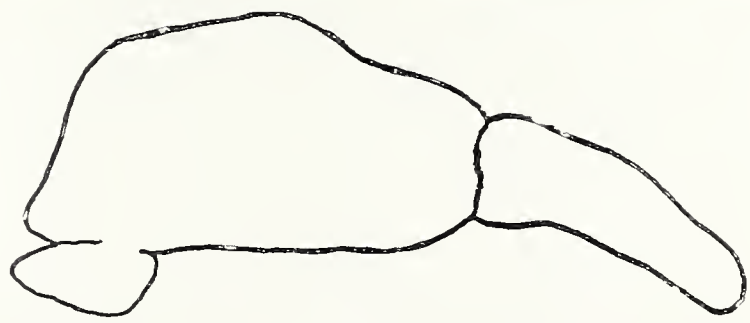
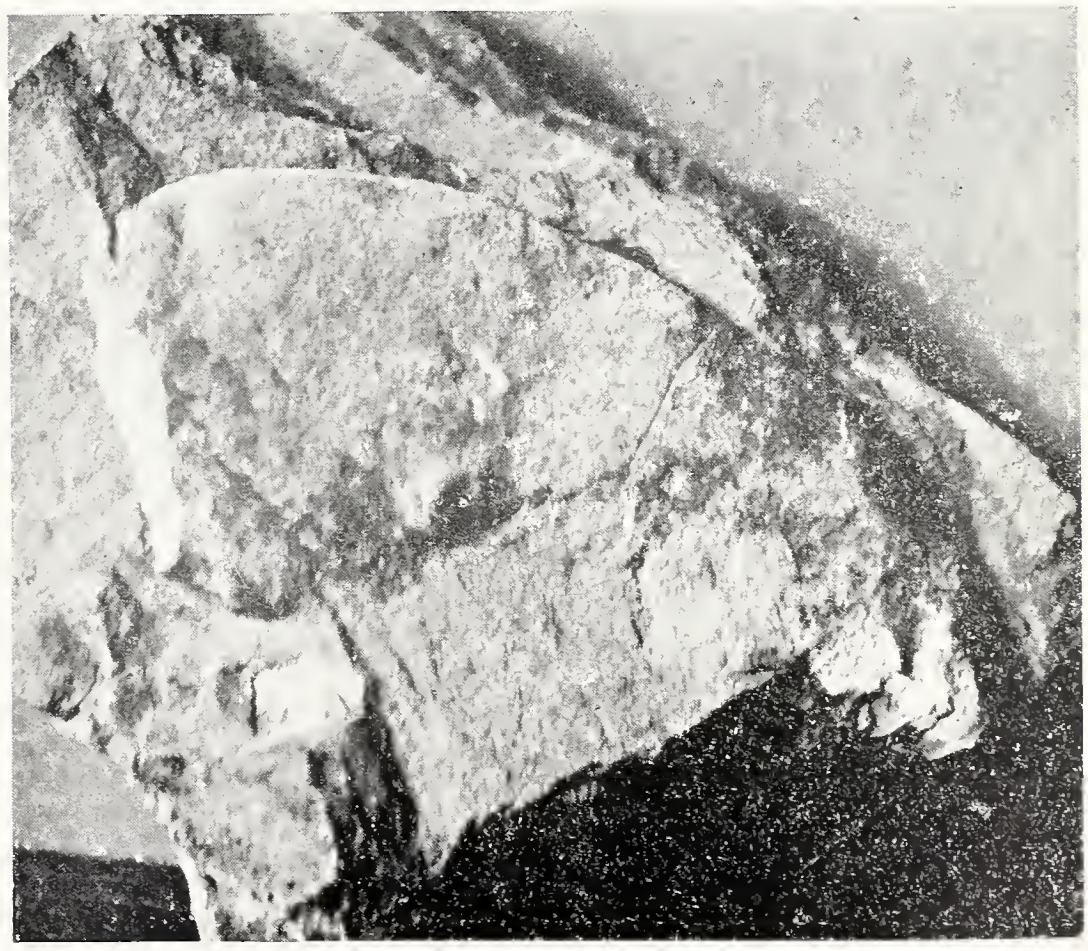


FIG. 2.



F.C., photo. FIG. 3.

LOWER ORDOVICIAN: NEAR HEPBURN, VICTORIA. (?) HYMENOCARIS HEPBURNENSIS, SP. NOV.

About natural size

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Description of a New Species of Phyllocarid.

(?)*Hymenocaris hepburnensis*. Plate XXVIII.

Description.—Based upon the two specimens figured.

Casts of the carapace and abdominal segments. Carapace subtriangular, highest towards the front, which is flattened or even slightly concave; dorsal margin longest, widely curved, sloping rapidly to the posterior margin, which it meets at a sharp angle; the posterior extremity narrow and concave. Ventral border short, nearly straight, concave in the posterior third. In the mandibular region, in one specimen, there is an impression of a stout, elliptical body, which may be the indication of a rostral element. Abdominal segments closely conjoined to the body of the carapace, widely arched, and consisting of about seven subquadrate joints, slightly narrowing to the extremity, which is more or less rounded off. No caudal spines seen in the specimens examined.

Measurements.—Larger example (imperfect). Length, 81 mm.; height of carapace, 35 mm.; height of carapace at junction with abdominal segments, 16 mm.; width of last segment on specimen, 10.5 mm.

Smaller example.—Total length, 55 mm.; length of carapace, 34·5 mm.; greatest height of carapace, 22 mm.

Observations.—This species is provisionally referred to the genus *Hymenocaris* on account of the saddle shape of the carapace and the nearly straight posterior margin at the junction with the body segments. Another point of relationship with *Hymenocaris* is the comparatively short and curved series of abdominal segments. The rostral body, if such it be, does not appear to have been noticed in any examples of *Hymenocaris* yet described; and this feature tends to show a relationship with the *Ceratiocaridae*. It is probable that the discovery of better preserved specimens may necessitate the removal of this species to a new genus.

Hymenocaris is a Cambrian and Lower Ordovician genus in Europe. *Ceratiocaris*, although typically Silurian, has a few doubtful representatives in the Ordovician.

The present species is usually abundant in the beds where it occurs, some blocks of shale showing on the joint faces layers of these organisms distributed along the bedding planes. As is usual with the larger phyllocarids preserved in shale, the form of the carapace is somewhat variable, owing to deformation by pressure.

By the accompanying graptolites, as determined by Dr. T. S. Hall, the beds in which this fossil occurs seem to be referable to the upper limit of the Bendigonian series.

Explanation of Plates.

Plate XXVII.

Slab of L. Ordovician shale, No. 2404, with *Caryocaris marri*, Hicks and *C. wrighti*, Salter. About natural size.

Plate XXVIII.

Fig. 1.—Cotype of (?)*Hymenocaris hepburnensis*, sp. nov. No. 1933. Jim Crow Creek.

Fig. 2.—Outline of above specimen.

Fig. 3.—Second cotype of (?)*Hymenocaris hepburnensis*, sp. nov. No. 1470. Junction of Spring and Jim Crow Creeks. Figures about natural size.

[*Report sent in 13.12.09.*]

REPORTS ON ORDOVICIAN FOSSILS.

By Frederick Chapman, A.L.S., &c., Palæontologist, National Museum.

Dr. Wolfenden's Paddock, Parish of Painswick. Collected by Mr. W. H. Ferguson. Nos. 1909, 1913, 1914, 1916.

A graptolite and some indeterminate (?)organic remains.—1909.

Stephanella sp. (determined by Dr. T. S. Hall).—1913.

In addition to *Dictyonema* sp., determined by Dr. T. S. Hall, there is a conical, concretionary body separated by transverse cracks, probably the cast of the abdominal somites of a crustacean.—1914.

(?)*Stephanella* (determined by Dr. T. S. Hall).—1916.

Age.—Lower Ordovician: probably at the base of the series.

Parish of Barp. Collected by Mr. W. H. Ferguson. Nos. 1906, 1918, 1919, 1921, 1922, 1925, 1927-1929, 1932, 1936.

(?)*Rhinopterocaris maccoyi*.—1906, 1918, 1922, 1928.

(?)*Crustacean* remains.—1927, 1932.

(?)*Dictyonema* (determined by Dr. T. S. Hall).—1919, 1925, 1929.

(?)*Dictyonema* (determined by Dr. T. S. Hall) and (?)crustacean remains.—1921.

No determinable fossil.—1936.

Age.—Similar to the above.

[*Report sent in 13.2.08.*]

Shaly Mudstone, Painswick: near peg 415. Nos. 297-309, 312, and 326-340. Coll. by Mr. W. H. Ferguson.

Cast of a branching (?)monticuliporoid.—297-305.

Small rounded bodies of a problematic nature, possibly of crustacean origin, 298, 299, 302, 307-309, 328, 330, 335, 338.

Phyllocarid carapace and appendages, badly preserved. Probably allied to *Rhinopterocaris*.—303.

Carbonaceous remains of a crustacean allied either to *Hymenocaris* or *Rhinopterocaris*, with separated telson.—329, 333.

(?)Appendage of a phyllocarid.—304.

Organic remains, probably crustacean—indet.—312, 326, 327, 340.

Fossil remains, indet.—300, 301, 306, 331, 334.

Painswick: near peg 409. Nos. 310, 311, and 314-321.

Remains of a (?)crustacean, probably allied to *Hymenocaris* (retained for further examination).—316, 318, 321.

Obscure organic markings, indet.—310, 311, 314, 315, 317.

Painswick: 12 chains W. of peg 364. Nos. 322-325

(?)Crustacean remains and trails, indet. (Retained for further examination.)

Taylor's, Painswick. No. 313.

(?)Crustacean remains, indet.

The above specimens are probably from the base of the Lower Ordovician.

Shale.—Jordan River, 2½ miles above Jericho. Nos. 341*a*, 341*b*. Coll. by Mr. O. A. L. Whitelaw.

Two impressions of a brachiopod, which may be tentatively referred to *Siphonotreta*. The shell, although incomplete, shows concentric growth lines, and traces of the tubular spines crossing the lamellæ. The chitinous appearance of the original shell is well preserved. (One specimen retained for description.)

Shale.—Little Jordan Creek, 50 chains above Jordan Junction. No. Coll. by Mr. O. A. L. Whitelaw.

Lituites sp. A small form, probably new, allied to *L. lituus*, Montfort. (Retained for description.)

The specimens from both the above localities are of Ordovician age.

Pyritous Mudstone, Coy's Diggings, S. of Rushworth. Nos. 605-611. Coll. by Mr. S. B. Hunter.

Dendroid markings resembling the so-called fucoid *Bythotrephis*. Probably of organic origin, and may be ascribed to a borer, as the branched markings are disposed at various, but low, angles to the bedding plane of the rock. They are compressed-elliptical in cross section. Similar remains are found in both Ordovician and Silurian rocks.

REPORTS ON FOSSILS—SILURIAN AND DEVONIAN FOSSILS FROM THE MITTA MITTA DISTRICT, N.-E. VICTORIA.

By Frederick Chapman, A.L.S., F.R.M.S., Palæontologist to National Museum, Melbourne.

(Plate XXIX.—XXXII.)

Fossiliferous Limestone. Stony Creek, Limestone Creek, Benambra —Nos. 272-278. Coll. by Mr. E. J. Dunn, F.G.S.

272.—This limestone specimen is of a pink tint, relieved with green veins. The rock is of organic origin, but is now almost entirely recrystallized. The seams and veins of a greenish colour are due to chloritic and sandy impurities disseminated in reticulating stripes throughout the rock (see Pl. XXIX., Fig. 1). The original limestone reef appears to have been broken up by local earth movements, and the intercalated layers of (?)volcanic gritty ash have surrounded and coated the brecciated fragments of limestone. A large amount of shearing has taken place during the dynamical movements of this limestone massif. The only organic remains decipherable in the limestone are—A fragment of a large stromatoporoid, crinoid ossicles, and valves of ostracoda, with, possibly, fragments of trilobite tests.

273.—A gritty limestone, sheared and recrystallized. Organic remains chiefly crinoidal.

274.—Limestone with corals (*Cyathophyllum* (?)*sweeti*, Eth. fil.; see Appendix and Pl. XXIX., Fig. 2), polyzoa and crinoid ossicles.

275.—Limestone with crinoid remains, shell fragments and corals, *Cyathophyllum* (?) *sweeti*, Eth. fil. (See Appendix and Pl. XXIX., Fig. 3). In this rock a fragment of a decomposed igneous (?) basic rock occurs.

276.—Coral limestone with a gritty matrix. *Favosites multitabulata*, Eth. fil. (See Appendix, and Pl. XXX., Figs. 4 and 5); also a monticuloporoid, indet.

277.—A crinoidal limestone with the interstitial material formed of green chloritic products. The included organisms consist largely of crinoidal ossicles, and are accompanied by a few fragments of polyzoa. (See Pl. XXXI., Fig. 6.)

278.—A limestone composed chiefly of crinoid ossicles and stem-joints. A few obscure corals seen on the weathered surface. The main part of the rock is recrystallized, and the calcitic fragments show secondary lamellar twinning, induced by pressure. (See Pl. XXXI., Fig. 7.)

Age.—Probably Devonian.

Fossiliferous Limestone.—Glen Wills, Wombat Creek. Coll. by Mr. E. J. Dunn, F.G.S. Nos. 1456-1461.

1456.—From first large outcrop N. of Limestone Gap, Wombat Creek, near Glen Wills. The weathered surface of this limestone specimen exhibits a species of *Favosites* (a ramose form); a moderately large, encrusting stromatoporoid; and several corallites of small rugose corals, indet. The microscope slide made from the rock does not assist the determination of the corals, since the material is secondarily crystallized and largely dolomitized.

1457.—Limestone Gap, Wombat Creek, near Glen Wills.—A much altered limestone; containing some obscure remains of corals.

1458.—Limestone Gap, Wombat Creek, near Glen Wills.—Corals and stromatoporoids, indet. Rock much altered

1459.—First limestone S. of Limestone Gap, near Glen Wills.—Fossil contents not well preserved. Indications of the presence of a (?)*Tryplasma*, sp. indet.

1460 and 1461.—First large outcrop S. from Limestone Gap, Wombat Creek, near Glen Wills.—A gigantic stromatoporoid allied to *Clathrodictyon*. The laminæ are broken up by a series of oblique fracture planes, filled with crystals of dolomite. (See Pl. XXXII., Figs. 8 and 9.)

The age of these beds is doubtful. The evidence of the fossils, although rather slender, points to the Silurian. *Tryplasma* is a genus restricted to beds of that age, whilst *Clathrodictyon* is also common in the Silurian, and rare in the Devonian.

Limestone Outcrop.—Mitta Mitta River. Coll. by Mr. E. J. Dunn, F.G.S.

774.—A fine-grained brown sandstone, with a cast of brachiopod, probably referable to *Atrypa* sp.

Age uncertain.

Appendix on the Fossils.

Cyathophyllum (?) *sweeti*, Eth. fil. Plate XXIX., Figs. 2 and 3.

A transverse section of nearly one-half of the corallum of a *Cyathophyllum* is seen in microscope-slide 1103. The septa are stout, and number about 60 in the complete disc; the dissepiments are numerous in the peripheral half of the corallum. In many points this fossil seems to conform

Plate XXIX.

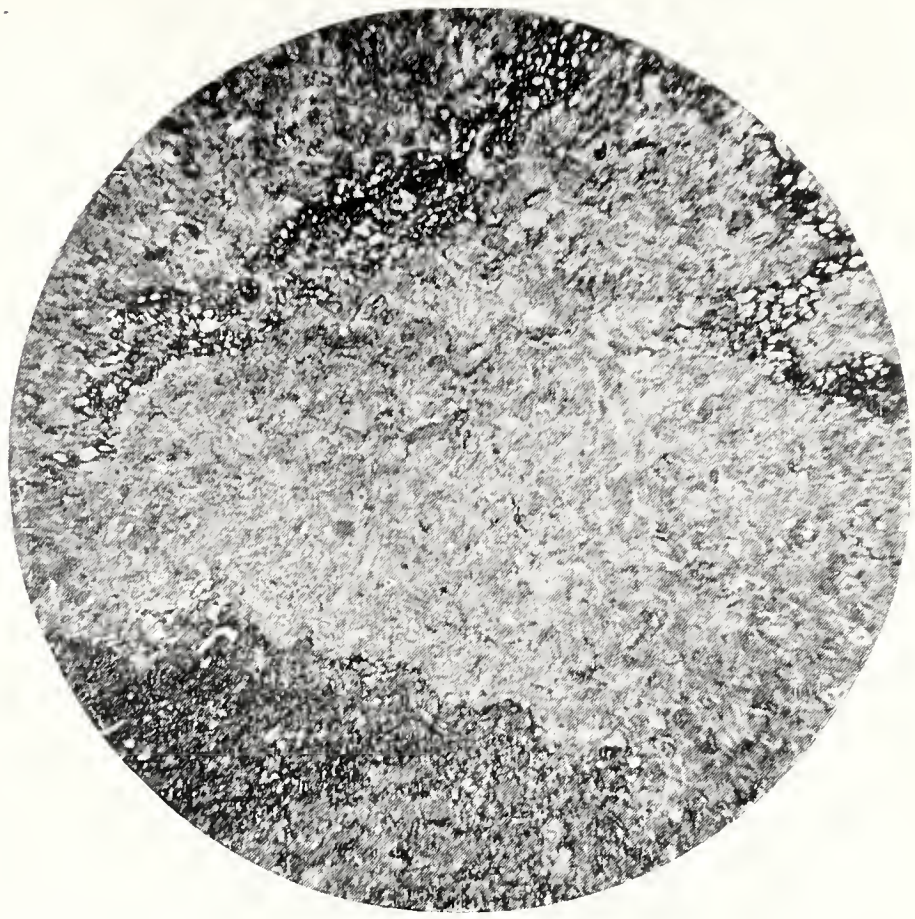

Fig. 1. × 7

Fig. 2. × 10

F.C., photo.

Fig. 3. × 6

BRECCIATED LIMESTONE AND CYATHOPHYLLUM: STONEY CREEK, LIMESTONE CREEK, BENAMBRA.

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Plate XXX.

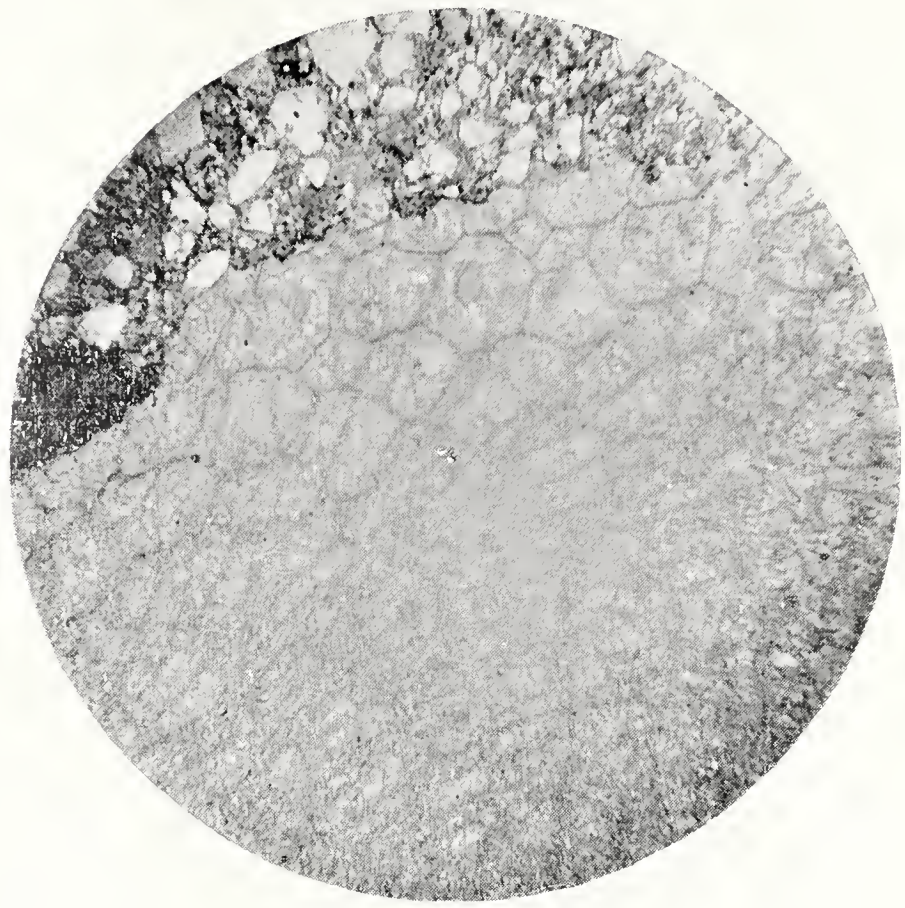

Fig. 4. × 7

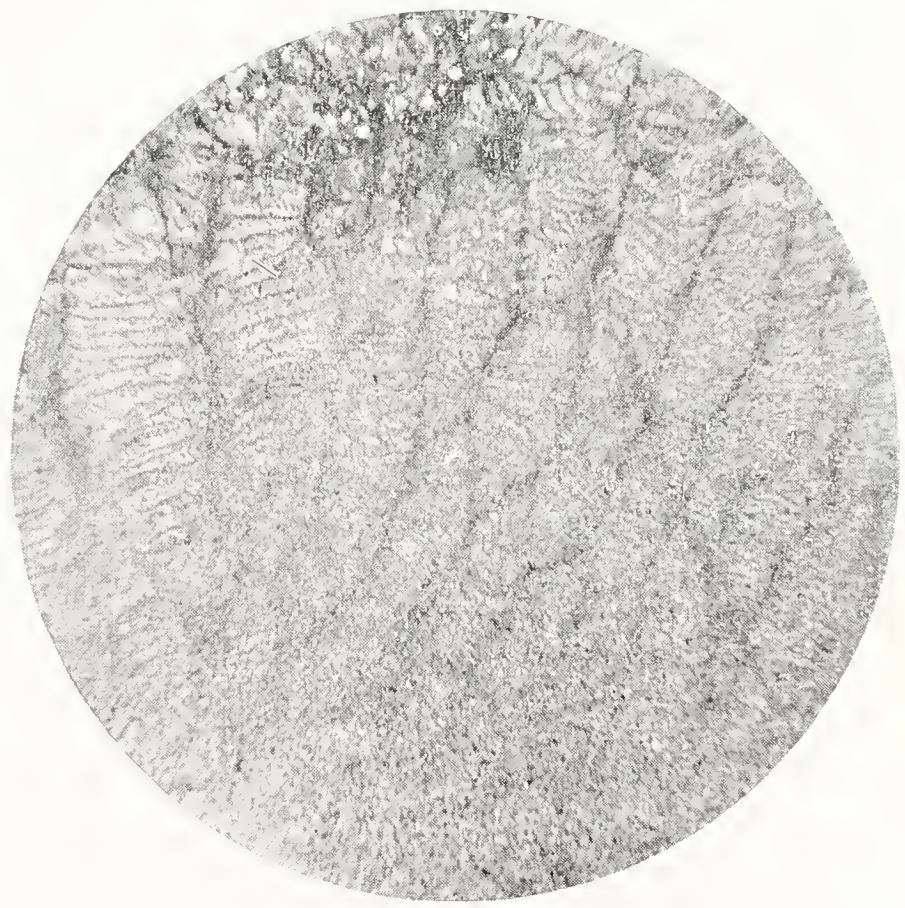

Fig. 5. × 7

F.C., photo.

FAVOSITES MULTITABULATA, ETH. FIL. : STONEY CREEK, BENAMBRA.

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PLATE XXXI.

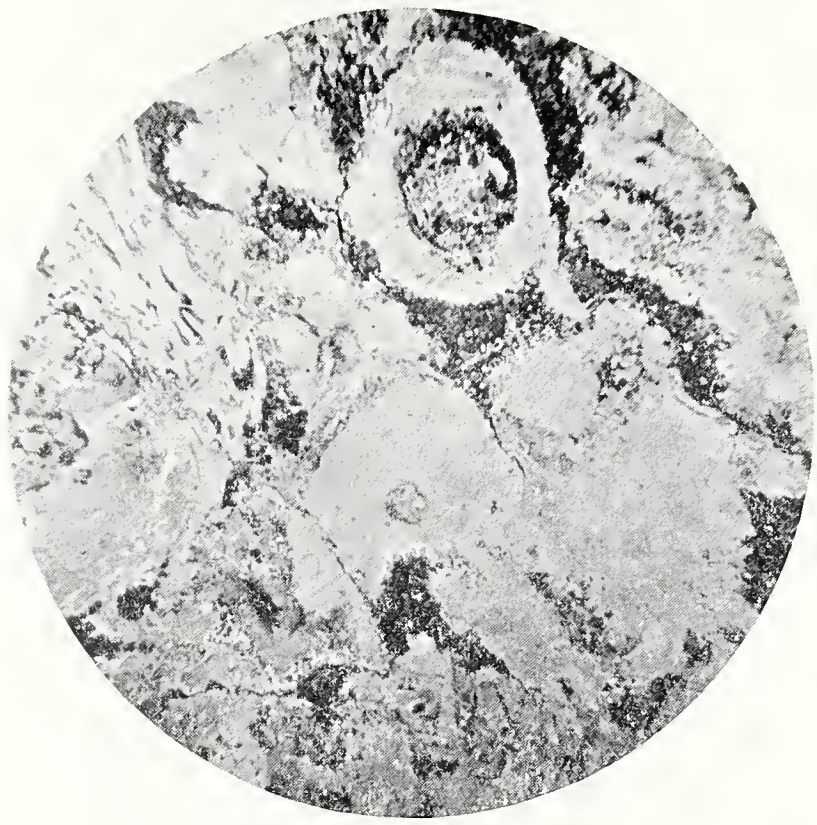

FIG. 6. × 7

FIG. 7. × 2

F.C., photo.

UNALTERED AND CRYSTALLIZED CRINOIDAL LIMESTONES : STONEY CREEK, LIMESTONE CREEK, BENAMERA.

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Plate XXXII.

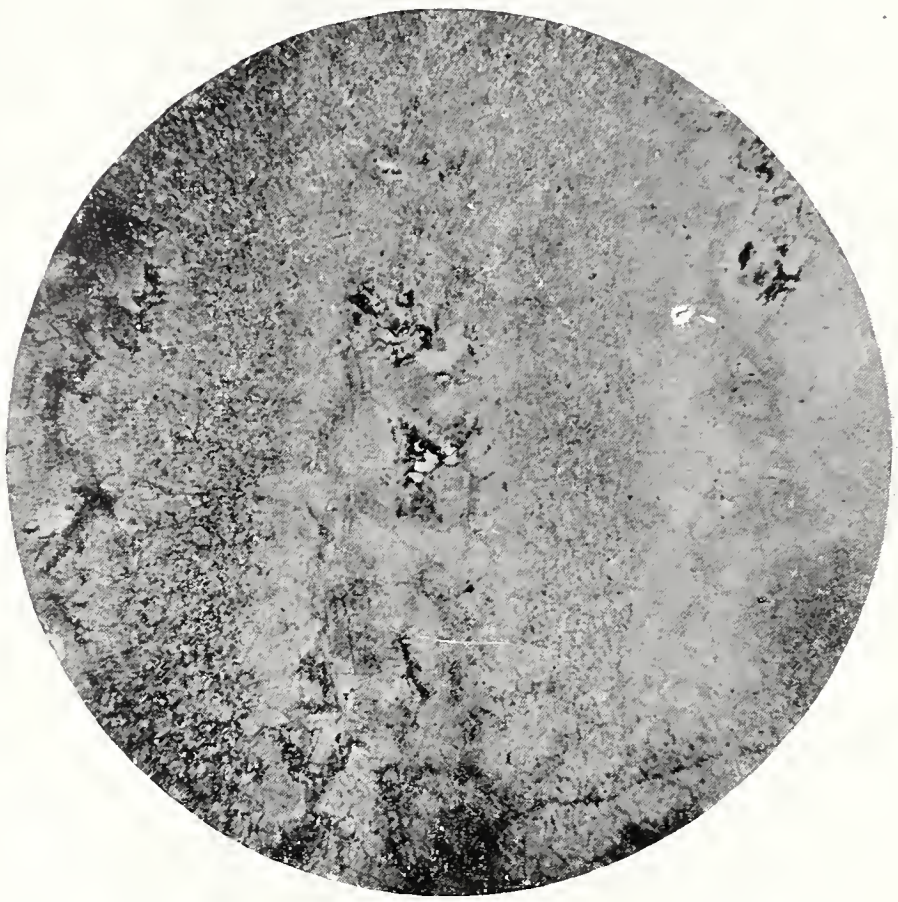

Fig. 8. × 7

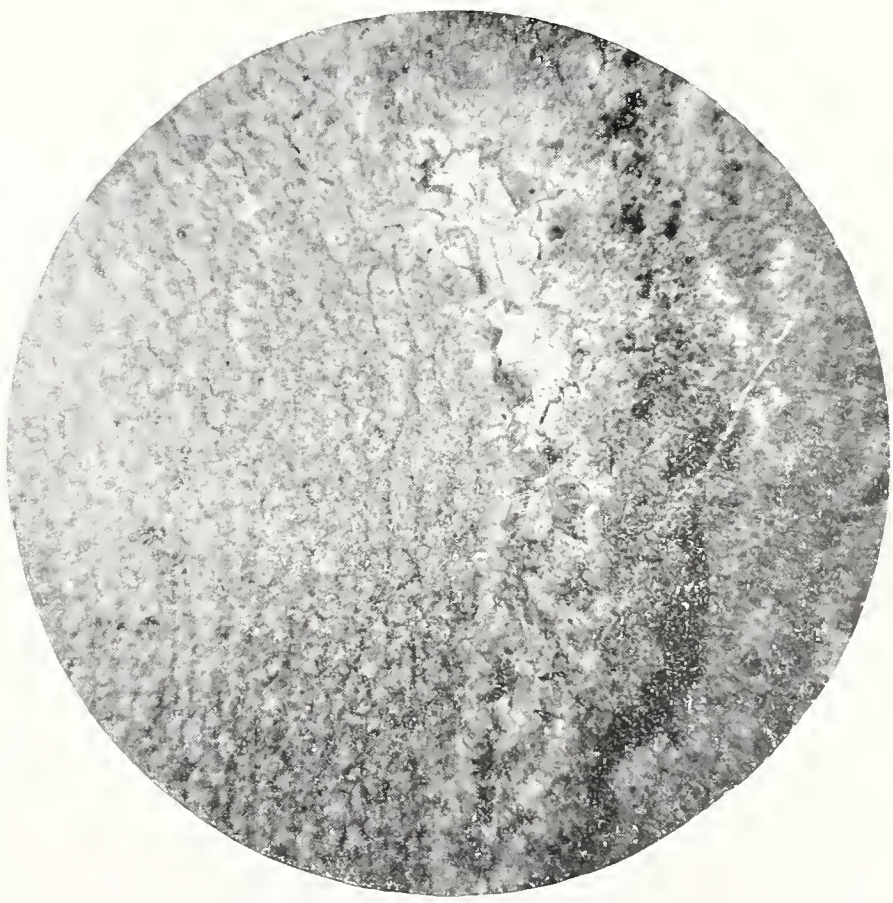

Fig. 9. × 7

F.C., photo.

STROMATOPOROID LIMESTONE: GLEN WILLS, WOMBAT CREEK.

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to the characters of the Middle Devonian *C. sweeti*, from Queensland[1]; and in the absence of the entire corallum, or of isolated specimens, it is here referred provisionally to that species.

Favosites multitabulata, Eth. fil. Plate XXX., Figs. 4 and 5.

Favosites multitabulata, Etheridge. Jun., 1899, Rec. Geol. Surv., New South Wales, Vol. VI., 1899, p. 168, Pl. XVIII., Fig. 6; Pl. XXVI.

The dimensions of the calices and the spacing of the tabulæ of the above species, as given by Mr. Etheridge (*loc. cit.*), exactly agrees with our specimen. The double series of mural pores is also present. There is no doubt that the Limestone Creek example belongs to this species, which I have already met with in the Middle Devonian of Bindi. Etheridge's original specimens came from Boodle's Freehold, near Moonbi, north-east of Tamworth, New South Wales.

Explanation of Plates.

Plate XXIX.

Fig. 1.—Brecciated limestone; showing the fragments invested with a layer of clastic material, consisting of quartz grains and a chloritic substance. Stony Creek, Limestone Creek, Benambra. No. 272 (Slide 1101). × 7.

Fig. 2.—Transverse section of part of corallum of *Cyathophyllum* (?)*sweeti*, Eth. fil. Showing the relation of the primary and secondary septa, and the curved and oblique dissepiments. Stony Creek, Benambra. No. 274 (Slide 1103). × 10.

Fig. 3.—Transverse section of a small portion of the corallum of *Cyathophyllum* (?)*sweeti*, Eth fil. Showing strongly convex dissepiments. Stony Creek, Benambra. No. 275 (Slide 1099). × 6.

Plate XXX.

Fig. 4.—*Favosites multitabulata*, Eth. fil. Transverse section of corallum. Stony Creek, Benambra. No. 276 (Slide 1104). × 7.

Fig. 5.—*F. multitabulata*, Eth. fil. Vertical section. Stony Creek. No. 276 (Slide 1105). × 7.

Plate XXXI.

Fig. 6.—Crinoidal limestone. Stony Creek. Rock very little altered. No. 277 (Slide 1100). × 7.

Fig. 7.—Recrystallized crinoidal limestone. Stony Creek. No. 278 (Slide 1106). × 28.

Plate XXXII.

Fig. 8.—Stromatoporoid limestone with dolomitized layers. Glen Wills, Wombat Creek. No. 1460 (Slide 1112). × 7.

Fig. 9.—Stromatoporoid limestone with dolomitized layers. The organic portion better preserved. Glen Wills, Wombat Creek. No. 1460 (Slide 1112 bis.). × 7.

[*Report sent in 26.4.10.*]

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1 *Cyathophyllum* sp. ind. Etheridge, jnr., Geology and Palæontology of Queensland and New Guinea (Etheridge and Jack), 1892, p. 59, Pl. III. Figs. 11 and 12. *C. sweeti*, Eth. fil. Proc. Linn. Soc. of New South Wales, Vol. IX. Pt. 3, 1895, p. 52, Pl. XL. Figs. 3, 4; Pl. XLI. Fig. 1.

REPORTS ON FOSSILS.—MIDDLE DEVONIAN OF THE BUCHAN DISTRICT.

By Frederick Chapman, A.L.S., F.R.M.S., Palæontologist to the National Museum.

(Plates XXXIII.—XXXVI.)

Fossiliferous limestone from the Buchan District, Nos. 761, 763, country rock, Good Hope Silver Mine, near Mackieson's, S. of Buchan.

761.—*Atrypa* sp., near *reticularis*, L. sp., but with a sloping hinge-line. Also *Spirifer yassensis*, de Koninck.

763.—*Spirifer yassensis*, de Koninck.

Fossiliferous limestone.—Spring Creek, near Buchan.—No. 762.

This rock is largely composed of the corallites of *Campophyllum gregorii*, Eth. fil. (See Appendix, Pl. XXXIV., Fig. 3.)

Fossiliferous limestone. Road-cutting, allot. 18, Buchan. Coll. Mr. A. E. Kitson.—Nos. 1001-1010.

1001.—This rock is largely composed of the shells of a turreted gasteropod belonging to the genus *Murchisonia* (see Appendix, and Pl. XXXVI., Fig. 8). The microscope slides show also numerous carapaces of ostracoda, and sections of a trilobite carapace, partially cutting through the proximal part of an appendage. (See Appendix, Pl. XXXVI., Fig. 13.)

1002.—Corallum of *Favosites basaltica*, Goldf. sp., var. *moonbiensis*, Eth. fil. (See Appendix, and Pl. XXXIII., Figs. 1, 2; Pl. XXXV., Fig. 7.) Portion of a large coral of the above species embedded in, or conjoined to, a mass of reef material, consisting of small corals (*Favosites* and *Campophyllum*) and brachiopods.

1003.—A block of limestone largely consisting of the coralla of *Campophyllum gregorii*, Eth. fil., and a few other corals, indet.

1004-7.—Weathered coralla of *Campophyllum gregorii*.

1008.—*Campophyllum gregorii* and a *Spirifer*, indet.

1009-10.—Limestone, with abundant examples of *Campophyllum gregorii*. In No. 1010, one of the examples, incomplete, measures two and three-quarter inches in length.

Duke's Allot., Buchan Township. Coll. A. E. Kitson.—Nos. 1011-1020.

1011.—(?) *Cyathophyllum* sp. and *Favosites multitabulata*, Eth fil. (a young corallum of about 2 cmm. in width; see Plate XXXV., Fig. 6).

1012.—Weathered limestone, with fossils standing out in high relief. Containing corals, indet.; *Spirorbis ammonius*, M. Edw., var. *truncata*, nov. (See Appendix and Plate XXXVI., Fig. 9); *Spirifer yassensis*, de Kon.; (?) *Athyris* sp.; *Murchisonia* sp. (See Appendix.)

1013.—Weathered surface, showing indeterminate corals and *Spirorbis ammonius*, M. Edw., var. *truncata*, nov.

1014.—*Pleurotomaria* sp. indet.

1015.—*Campophyllum gregorii*, Eth. fil. and (?) *Spirifer* sp.

1016.—*Conocardium* sp. A form with curved radial riblets and short alæ. Probably referable to *C. sowerbii*, de Kon. (See Appendix.)

1017.—(?) *Campophyllum* and *Spirifer yassensis*.

1018.—Two specimens of ostracoda, here described as *Primitia cuneus*, occur on the weathered surface of this rock-specimen (see Appendix and Plate XXXVI., Figs. 10-12). Also *Campophyllum* and *Spirifer* sp.

1019.—On the weathered surface occur (?) *Campophyllum; Spirorbis ammonius*. M. Edw., var. *truncata*, nov.; *Spirifer yassensis;* and numerous small organisms, indet.

1020.—*Campophyllum; Spirorbis ammonius*, var. *truncata;* and *Spirifer yassensis*.

Appendix on the Fossils.

Anthozoa.

Campophyllum gregorii, Eth. fil., Pl. XXXIV., Figs. 3, 4, 5.

Campophyllum gregorii, Etheridge, jnr., 1892, Geol. and Palæont. of Queensland and New Guinea, p. 60, Pl. III., Figs. 15-18.

Idem. 1895, Proc. Linn. Soc. New South Wales, vol. IX. pt. 3, p. 522, Pl. XL., Fig. .

The present occurrence of *C. gregorii* is newly recorded for this State. The coral is very variable in size and habit, and was apparently greatly influenced during growth by the nature of the surroundings; for the impure, muddy limestone of Bindi yields a small stunted variety, whilst the purer limestones of Buchan contain well-developed forms, more comparable with the original specimens described by Mr. Etheridge, from Queensland. The Victorian examples usually measure up to 2 inches in length, but one specimen measures $2\frac{3}{4}$ in. The Queensland specimens described by Etheridge attain a length of $2\frac{1}{2}$ inches.

The enlarged sections now figured are from specimens obtained at Bindi, in the National Museum collection. In the vertical section it will be noticed that the cup in the earlier stage of the growing coral became partially filled with fine organic mud, which was entrapped by the subsequent rejuvescent growth of the coral from the midst of the calyx. Numerous instances of this mode of calicinal gemmation are to be found in the Buchan limestone of this series. The limestone of Bindi here referred to contain numerous ostracoda in the dark calcareous matrix; and to the presence of these organisms, no doubt, the pungent odour of the rock when struck is due.

Favosites basaltica, Goldfuss sp. var *moonbiensis*, Eth. fil., Plate XXXIII., Figs. 1, 2; Plate XXXV., Fig. 7.

Favosites basaltica, Goldfuss sp., var. *moonbiensis*, Etheridge, jnr., 1901, Rec. Geol. Surv. N. S. Wales, vol. VI. p. 164, Pl. XXIV. Figs. 1. 2; pl. XXIX. fig. 2.

This variety is distinguished by Mr. Etheridge from *F. gothlandica* in having smaller and more uniformly-sized corallites. Also in the uniserial arrangements of mural pores, and the more closely-set tabulæ.

It is interesting to find in the Buchan limestones two forms of the genus *Favosites* which were originally described by Mr. Etheridge from the Moonbi limestone of New South Wales. Moreover, this evidence helps to correlate that horizon with the Middle Devonian of the Gippsland area; especially since Mr. Etheridge remarks about the Moonbi limestone fossils as follows (op. cit., p. 182):—"With regard to the 3rd locality little or nothing is known about its stratigraphical position, but I am inclined to believe that it will be found to be somewhat older than the Woolomol and Moore Creek limestones." A doubtful occurrence of this form in older beds in Victoria at Thomson River is recorded elsewhere in this publication. (See p. 80.)

Vermes.—Tubicola.

Spirorbis ammonius, Milne Edwards, var. *truncata*, var. nov.

Plate XXXVI., Fig. 9.

This interesting little annelid tube is frequent on the weathered surfaces of the Buchan limestone in the present collection. It is closely allied to the type species[1], found by Goldfuss in the Middle Devonian of Germany[2]; having a spiral tube divided by varices or ridges at moderately regular intervals. Our specimens differ invariably in having one face almost flat, the other strongly convex; whilst the ridges tend to give place to corresponding depressions, thereby imparting to the shell an appearance of the foraminiferal test of a *Truncatulina*. An interesting feature of this variety is the mode of attachment; which is by the side of the tube and not on the flat coiled face as in *Spirorbis omphalodes*, Goldfuss[3]. The strong annular lines of growth common to the *Serpulidæ* are well seen in these examples. A frequent character in our specimens is the tendency of the later part of the tube to be partially uncoiled, as is sometimes seen in *S. omphalodes*, the commoner spirorb of the Devonian system.

Measurements.—The diameter of the coiled portion of the tube measures from 2 to 3.5 mm. Average width of tube at mouth, 1.75 mm.

Pelecypoda.

Conocardium cf. *sowerbii*, de Koninck.

Cardium aliforme (var.), Sowerby, 1840, Trans. Geol. Soc. Lond., ser. 2, vol. V., Pl. LVI., Fig. 2.

Pleurorhynchus aliforme, J. Phillips, 1840, Pal. Foss. Cornwall, p. 34, Pl. XVII., Fig. 51.

Conocardium sowerbyi, de Koninck, 1887, Foss. Pal. Nouv.-Galles du Sud, p. 109; idem 1898, Descr. Pal. Foss. New South Wales.—Mem. Geol. Surv. N.S.W. Palæont. No. 6, p. 87.

There is little doubt that the examples before us belong to the above species; but since it is a weathered specimen with a much etched surface, it is referred to it with some reservation. It is important to note that this species was met with by de Koninck in black argillaceous limestone of Devonian age in the Yass district, New South Wales.

Gasteropoda.

Murchisonia sp.

Plate XXXVI., Fig. 8.

A small species of this genus is fairly abundant in the Buchan limestone. In the thin sections it is seen to have sub-angulated whorls, and an umbilicus. A weathered example shows a trace of a median slit-band. The shell is minute, being only 6.75 mm. in length in the largest weathered-out example in this limestone. Whorls about seven, the sides giving an apical angle of 30 deg. The present specimens are not well enough preserved to

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1. *Spirorbis ammonius*, Milne Edwards (in Lamarck), 1818, Hist. Nat., vol. V., p. 616.
2. *Serpula ammonia*, Goldfuss, 1826, Petrefacta Germaniæ, vol. I., p. 225, pl. LXVII. Fig. 2.
3. *Serpula omphalodes*, Goldfuss, 1826, tom. cit., p. 225, pl. LXVII., Fig 3.

describe more fully, for a specific diagnosis, but comparison may be made with the Devonian *Murchisonia anglica*, d'Orbigny[1], to which it seems to show most affinity.

Trilobita.

The slide No. 1354, Plate XXXVI., Fig. 13, shows a section of a trilobite carapace, attached to which is part of an appendage. It lies on the outer and ventral side, and resembles the so-called hydrospires of *Cheirurus* and allied forms. This peculiar and interesting structure consists of about 33 curved and flexuous processes emanating from a shelly layer attached to the ventral surface of the trilobite test, the curvature of the teeth-like process being so great as to cause the series to simulate a tube. On a detached portion of the same carapace, lying to one side are the remnants of three other quasi-spiral appendages, these latter terminating in a conical point. The structures seem to be comparable with the "branchiæ" in *Ceraurus* and *Calymene*, from the Trenton limestone, figured by C. D. Walcott[2]. In all probability they are homologous with parts of the exopodites seen in other genera. The only trilobite occurring in the Buchan limestone, so far as I have seen, is a *Cheirurus*, collected by the late James Stirling, F.G.S., and it is significant that similar structures to that now figured are met with in this and related genera.

Ostracoda.

Primitia cuneus, sp. nov. Plate XXXVI., Figs. 10-12.

Description.—Carapace seen from the side, broadly ovate; dorsal edge nearly straight, ventral, convex; anterior margin roundly truncate at the antero-ventral angle: posterior margin broad and bluntly rounded. Edge view, long-ovate, sub-acute anteriorly, swollen at posterior end. The median region of the dorsal area of the valves carries a slight depression, representing the median sulcus; whilst below, at the middle line and near the anterior, is a small pit or median depression. Surface of valves relieved by faint areolations, as in *P. nitida*, Roemer sp.

Two specimens from No. 1018, one of which is figured as the holotype.

Measurements.—Dimensions of figured specimen.—Length of carapace, 0.96 mm.; height, 0.76 mm.; thickness, 0.41 mm.

Affinities.—The above specimens are somewhat allied to F. A. Roemer's *Primitia nitida*[3], which according to Prof. Rupert Jones, possesses features which "are liable to much modification"[4]. However, the sulcus and median pit in the Buchan species are not nearly so distinct as in *P. nitida*. in which features it more nearly approaches *P. mundula*, Jones[5], as well as in its more distinct marginal rim. *P. mundula*, it may be remarked, is an Upper Silurian and Lower Devonian form.

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1. Prodrome, vol. I., 1849, p. 76. *Pleurotomaria angulata*, Phillips sp. Sandberger, 1856, Verst rhein. Schichtensyst. Nassau, p. 204, pl. XXIV., Fig. 19. *Murchisonia anglica*, d'Orbigny, Whidborne 1896, Pal. Soc. Lond., Mem. Dev. Fauna of S. of England, vol. III., pt. I., p. 59, pl. VI., Fig. 14.

2. Bull. Mus. Comp. Zool., vol. VIII., No. 10, 1881, pp. 220, 221, pl. III., especially figs. 6 and 9.

3. *Cypridina nitida*, F. A. Roemer, Palæontographica, vol. III., pt. II., 1852, p. 28, pl. IV., figs. 20, *a*, *b*.

4. Ann. and Mag. Nat. Hist. Pal. Bivalved Entom., No. XXXI. Some Devonian Species, vol. XV. ser. 6, 1895, p 62.

5 Jones. Ann. and Mag. Nat. Hist., vol. III., ser. 6, 1889, p. 376.

Explanation of Plates.

Plate XXXIII.

Fig. 1.—*Favosites basaltica*, Goldfuss sp., var. *moonbiensis*, Eth. fil. Transverse section of corallum. Buchan, E. Gippsland. No. 1002 (Slide 1355). × 14.

Fig. 2.—*F. basaltica*, Goldf. sp., var. *moonbiensis*, Eth. fil. Vertical section of corallum. Buchan, No. 1002 (Slide 1355). × 14.

Plate XXXIV.

Fig. 3.—*Campophyllum gregorii*, Eth. fil. Worn surface of limestone showing numerous coralla. The twisted form of the largest example is due to calicular gemmation. Spring Creek, near Buchan. No. 762. Four-fifths nat. size.

Fig. 4.—Transverse section of corallum of *Campophyllum gregorii*, Eth. fil. Showing the outer vesicular zone. Bindi, E. Gippsland. Nat. Mus. coll. × 7.

Fig. 5.—Vertical section of corallum of *C. gregorii*, Eth. fil. Showing the outer vesicular zone and curved tabulæ. Bindi, E. Gippsland. Nat. Mus. coll. × 7.

Plate XXXV.

Fig. 6.—*Favosites multitabulata*, Eth. fil. Weathered surface of a small corallum; showing a natural vertical section. Buchan, E. Gippsland. No. 1011. × $\frac{5}{3}$.

Fig. 7.—*Favosites basaltica*, Goldf. sp., var. *moonbiensis*, Eth. fil. Weathered surface of a large corallum; showing underlying reef material of calcareous mud filled with brachiopods and small corals. Buchan, E. Gippsland. No. 1002. × $\frac{3}{2}$.

Plate XXXVI.

Fig. 8.—Thin slice of Middle Devonian Limestone, with shells of *Murchisonia* sp. cut at various angles; one passing through the base, showing perforate columella. Buchan. No. 1001 (Slide 1353). × 14.

Fig. 9.—Two examples of *Spirorbis ammonius*, M. Edwards, var. *truncata*, nov.; showing the truncate spiral face *a* and the convex oral face *b*. Co-types. Detached from rock-specimens 1012 and 1020. Buchan. × 7.

Fig. 10.—*Primitia cuneus*, sp. nov. Showing right valve. Buchan. Detached from No. 1018. × 29.

Fig. 11.—*P. cuneus*, sp. nov. Outline of carapace seen from the dorsal edge. × 24.

Fig. 12.—*P. cuneus*, sp. nov. Part of valve-surface, showing the median pit and surface ornament. × 100.

Fig. 13.—Fragment of an appendage of a trilobite, (?)*Cheirurus*. Buchan. No. 1101 (Slide 1354). × 35.

[*Report sent in 26.4.10.*]

Plate XXXIII.

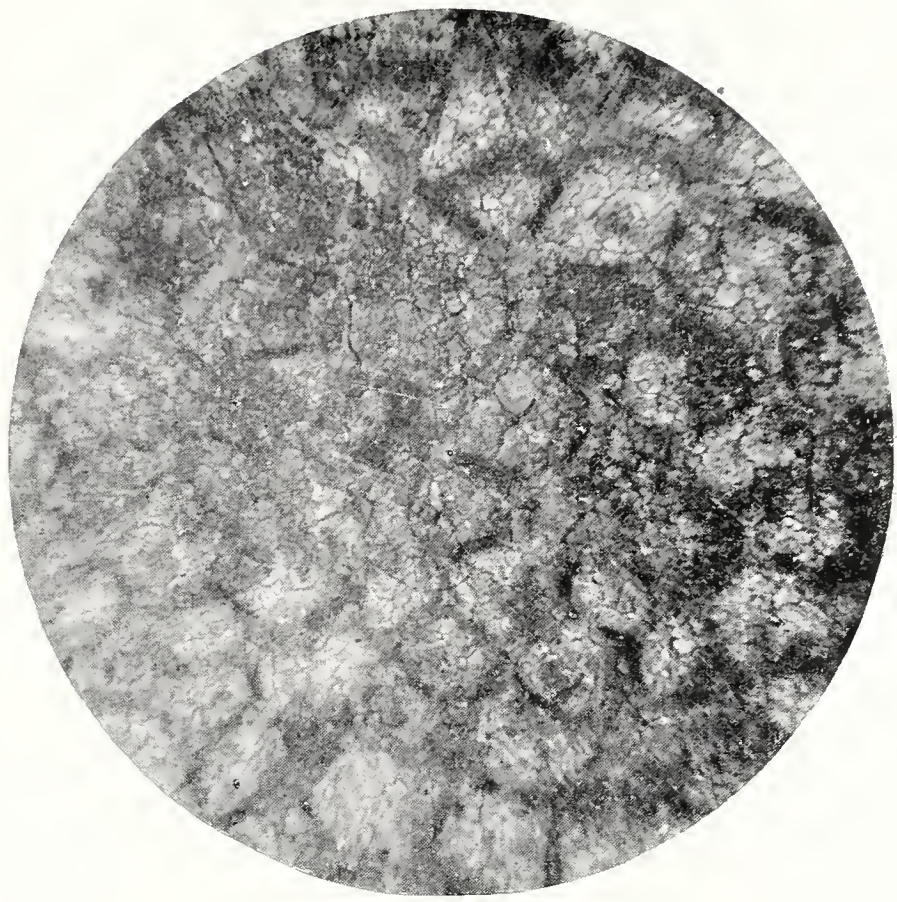

Fig. 1. × 14

Fig. 2. × 14

F.C., photo.

FAVOSITES.—MIDDLE DEVONIAN LIMESTONE: BUCHAN.

BRITISH MUSEUM
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NATURAL HISTORY

Plate XXXIV.

Fig. 3. × $\frac{4}{5}$

Fig. 4. × 7

F.C., photo.

Fig. 5. × 7

CAMPOPHYLLUM.—MID. DEVONIAN LIMESTONE: BUCHAN AND BINDI.

BRITISH MUSEUM
G D
NATURAL HISTORY

PLATE XXXV.

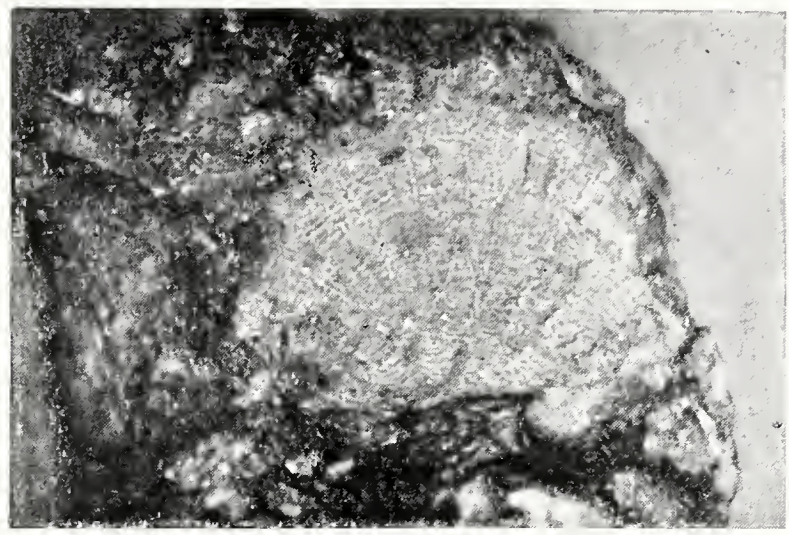

FIG. 6. × $\frac{5}{3}$

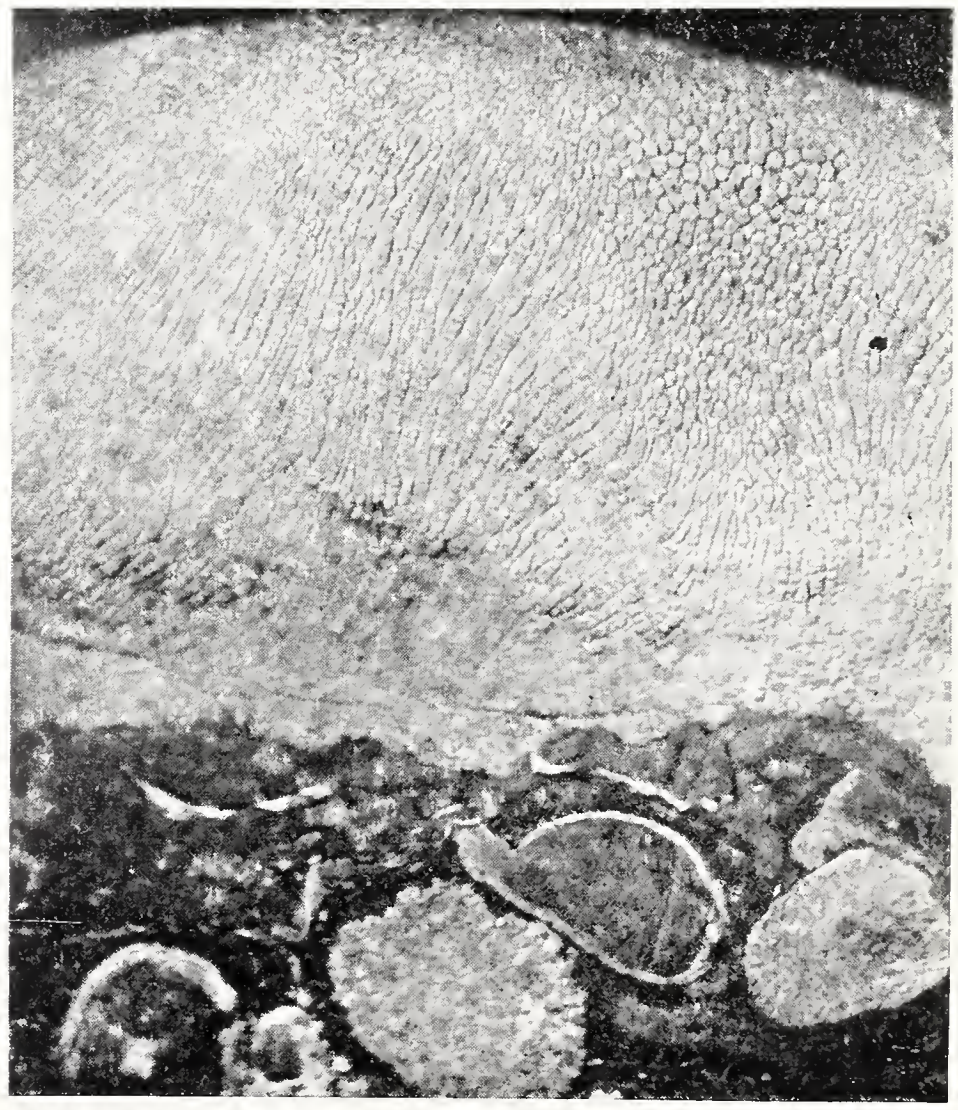

FIG. 7. × $\frac{3}{2}$

F.C., photo.

FAVOSITES.—MID. DEVONIAN LIMESTONE : BUCHAN.

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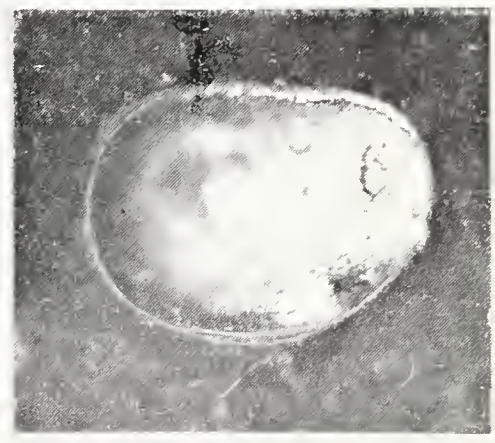
PLATE XXXVI.

8 x 14



10 x29

11 x24

9 x 7

12 x100

13 x 35

F.C., photo.

WORMS, GASTEROPODS, AND CRUSTACEA.—MIDDLE DEVONIAN LIMESTONE: BUCHAN.

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NATURAL HISTORY

REPORTS ON FOSSILS.

By F. Chapman, A.L.S., &c., Palæontologist to the National Museum

Miscellaneous.

No. 596. Silver Spur Mine, Stanthorpe, Queensland.

This rock is a fossiliferous mudstone; the fossils are in the form of casts.

Stenopora sp., cf. *S. gimpiensis*, Eth. fil.

Crinoid stem-joints, indet. (impressions of articular faces).

Fenestella fossula, Lonsdale. Numerous fragments. (?)*Spirifer*. Impression of valve.

This rock is of Carbopermian age (Gympie Beds).

No. 1455.—Clonbinane, 1½ miles east of township.

A ferruginous sandstone with numerous casts of shells.

Crinoid stem impressions, indet.

Rhynchotrema (?) *formosa*, J. Hall sp.

Camarotœchia decemplicata, Sow. sp.

Atrypa (?) *reticularis*, L. sp.

Of Silurian (?) Melbournian) age.

Nos. 772, 773.—Bemm River, 5 miles from Club Terrace, East Gippsland.

A fine-grained reddish-brown, micaceous sandstone with obscure (?)organic remains.

No. 764.—Merrijig (Jas. Tomkins). Mansfield.

Caudal region of *Elonichthys* sp., probably referable to *E. sweeti*, A.S.W.

Carboniferous.

[*Report sent in 4.1.10.*]

NOTE ON THE CORRELATION OF TASMANIAN AND VICTORIAN JURASSIC STRATA.

By F. Chapman, A.L.S., &c., Palæontologist to the National Museum, Melbourne.

The flora of the Upper Mesozoic coal-bearing beds of Tasmania, as developed throughout the E. and S.E. and appearing again in the south, is only in part comparable with the Gippsland coal-measure flora. The Tasmanian Mesozoic beds contain, for example, a large proportion of plant forms characteristic also of an older series, such as we find associated in the Mesozoic plant-bearing beds of Queensland, and which association has led palaeobotanists to refer to them as Trias-Jura.

With careful and detailed stratigraphical work it may in the future be possible to separate the Tasmanian beds referred to by Mr. W. H. Twelvetrees, F.G.S.,[1] as "3. Upper Coal Measure Sandstone," into an older and a younger series; a work which, indeed, has already been begun through the published observations of Mr. R. M. Johnston, F.L.S. The list of plants from the Tasmanian Upper Mesozoic series given in Twelvetrees' paper [2] includes *Taeniopteris* spp., *Cladophlebis* ("*Alethopteris*"),

[1] Proc. R. Soc. Tasmania, 1902 (1900–1), p. 67.
[2] Op. supra cit., pp. 68, 69.

Baiera and *Ginkgo* (" *Salisburia* "), which are forms similar to those of the Gippsland coal-measures; whilst such types as *Macrotæniopteris*, *Phœnicopsis* (" *Zeugophyllites* ") and *Pterophyllum*, tend to show a lower horizon, presumably Triassic. A complete revision of the Tasmanian Mesozoic flora is very much needed, and would undoubtedly throw direct light upon their relationship to the Victorian coal-measures, which are of approximately similar age.

Mr. R. M. Johnston,[1] in *Further Contributions to the Fossil Flora of Tasmania*, has pointed out the probable sequence of these beds as shown in the occurrence of " *Zeugophyllites* " (*Phœnicopsis*) *elongatus* in the Ida Bay coal-measures; strata, which, as that author remarks, probably " supply an important link in the chain of plant life, connecting the close of the Permo-Carboniferous period with the beginnings of the Mesozoic period."

The Jurassic flora of the Tasmanian localities, Jerusalem, Fingal, Spring Hill, York Plain, Hamilton, Richmond, New Town, Sandfly, Recherche, South Cape, Longford, &c., appears to contain an assemblage which, with some few exceptions, as *Sagenopteris* and *Phœnicopsis*, is practically identical with that of the plant-bearing strata of Jurassic age in S. Gippsland, Cape Otway, and Western Victoria.

PRELIMINARY NOTE ON THE FOSSILIFEROUS ROCKS OF LIMESTONE CREEK, N.E. VICTORIA.

By Fredk. Chapman, A.L.S., &c., Palæontologist to the National Museum, Melbourne.

The collection of specimens submitted consists of grey shelly limestone, black fetid limestone and dark, iron-stained indurated shale. The fossil contents show these rocks to be of Middle Devonian age, and comparable with the Buchan limestones and Tabberabbera shales. Corals and brachiopods are abundant, with occasional crinoid remains. *Favosites* and *Spirifer* are among the most common genera met with.

[*Report sent in 13.2.08.*]

NEWER SILURIAN FOSSILS OF EASTERN VICTORIA.—PART II.

By Frederick Chapman, A.L.S., &c., Palæontologist to the National Museum, Melbourne.

Fossiliferous Grit.—Halford's House Hill, Kongwak, near Jumbunna. Nos. 797-857, and 1040-1075. Coll. by Mr. A. E. Kitson.

Haliserites Dechenianus, Göppert sp. (See Appendix.)—855. (Retained.)

Plant remains, indet.—1075.

A monticuliporoid, probably related to *Heterotrypa*.—827, 833.

Fragment of a coral, indet.—830.

A small tabulate coral.—843.

Casts of the articular surfaces of crinoid columars, and portions of stems.—797-800, 805, 810, 819, 835, 836, 838, 839, 846, 847, 850, 857, 1041, 1049, 1056, 1062, 1066, 1070.

Fenestella sp.—852.

A ramose (?)polyzoan.—1057.

(?)*Fenestella*.—802.

(?)*Strophonella*.—807.

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[1] Op. supra cit., 1894 (1893), p. 172.

(?)*Stropheodonta*.—815, 853.
A rhynchonellid, indet.—828, 832.
cf. *Camarotœchia*.—844.
Spirifer sp., indet.—806, 812, 821.
(?)*Atrypa*.—816, 825, 841.
Brachiopod remains, indet.—803, 804, 809, 814, 817, 824, 826, 831, 834, 837, 840, 842, 845, 848, 849, 851, 854, 856, 1040, 1042, 1048, 1050, 1054, 1059, 1060, 1062, 1065, 1068, 1069, 1070, 1072.
(?)*Nucula*.—813.
A lamellibranch shell, probably allied to *Palœoneilo*.—811.
cf. *Ctenodonta portlocki*, Chapm.—1051.
cf. *Nuculites*.—1070.
(?)*Actinopteria* (fragment).—818.
Fragmentary fossils, indet.—1043, 1047, 1058, 1061, 1063, 1064, 1067, 1073, 1074.
(?)*Euomphalus*.—801, 808, 823, 829.
The above fossils are nearly all fragmentary, or poorly preserved. What evidence there is points to a Yeringian facies.

Impure Limestone with Fossils. Seville. Collected by Mr. J. Hand. Nos. 290 and 291.

Lindstræmia sp. Several specimens; one showing calicular (rejuvenescent) gemmation.—290.
(?)*Uncinulus*.—291.
Silurian—Yeringian.

Fossiliferous Sandstone. Comet Creek, 2 miles above junction with Sunday Creek, Clonbinane.—No. 292. Coll. by Mr. A. E. Kitson.
Numerous casts of *Atrypa reticularis* and other obscure brachiopod remains.
Also *Pleurodictyum megastomum*.
Age.—Silurian (Yeringian).

Fossiliferous Grit from W. side of Allot. 11. Kerrie.—Nos. 612-635. Coll. by Mr. A. E. Kitson.
Heliolites sp.—622, 625.
Casts of encrinite stems.—613.
Platystrophia sp. An unusually small example.—626.
Spirifer sp.—621, 628.
(?)*Camarotœchia* sp.—623.
(?)*Atrypa*.—630, 631.
Hollow casts of fossils, indet.—612, 614-620, 624, 627, 629, 632-635.
Of Silurian age. The fossil evidence points in a general way to a Yeringian horizon, but is not entirely conclusive.

Fossiliferous Sandstone and Grit—Quarter Sheet 34 S.W.—S. boundary of sheet, 3 miles E. of S.W. corner. Near Jordan River.—Nos. 343-355. Coll. by Mr. O. A. L. Whitelaw.
Coral fragments, indet.—348.
Casts of crinoid columnars.—346, 355.
Fragments of crinoid stem.—354.

Casts of brachiopods, indet.—343-345, 347-350, 352-355.
Crustacean fragments, indet.—348, 352.
No identifiable fossils.—351.
Age, Silurian (probably Yeringian).

Fossiliferous Sandstone. First Gully E. of Argyle Mine, Jordan Mine.—Nos. 356-358. Coll. by Mr. O. A. L. Whitelaw.

Brachiopod fragments, indet.—356, 357.
Fossil remains, indet.—358.
Rock of shallow-water origin, showing distinct cross-bedding.
Age, Silurian (probably Yeringian).

Fossiliferous Shale. Spur between Jordan River and B. B. Creek.—Nos. 359-377. Coll. by Mr. O. A. L. Whitelaw.

Panenka gippslandica, McCoy sp.—375-377.
Panenka sp. (? *P. gippslandica*, juv.).—360, 371, 377.
(?)*Paracardium*.—367, 370, 377.
Actinopteria sp.—359, 364.
A pelecypod, indet.
Tentaculites matlockiensis, Chap.—361, 364.
Styliola fissurella, J. Hall, var. *multistriata*, Chapm.—361, 363, 364, 368, 371.
(?)*Orthoceras*.—369.
Ceratiocaris sp.; carapace and caudal appendages.—372, 373.
Ceratiocaris body segments.—361, 366, 371.
Crustacean carapace, cf. *Ceratiocaris*.—365.
(?)Tracks of *Ceratiocaris*.—374.
Indet.—362.
Nos. 359, 370, 373, 375, 377 retained for further examination.
The littoral conditions under which these ochreous and banded shales were deposited are clearly indicated by the presence of true ripple-marks and numerous tracks in all probability due to crustacea.

Shales and Limestone. Thomson River, Walhalla, &c. Quarter Sheet 22 S.W.

Near N. Boundary, Thomson River. (*Monograptus dubius* beds).—Nos. 378-392.

Haliserites Dechenianus, Göppert sp. (See Appendix).—378, 379, figd. specs. 390 and 391.
Ceratiocaris sp. (appendages).—386, 387.
Ceratiocaris cf. *salteriana*, Jones and Woodward. (See Appendix).—380 (retained for comparison).
Fossil remains, indet.—381, 382, 384, 385, 389, 392.

Fossiliferous Sandstone, Limestone, Mudstone, and Cherty Rocks. Thomson River, Aberfeldy Divide.—Nos. 393-407, 410-451. Collected by Messrs. A. A. Henderson and J. P. L. Kenny.

(?)*Cyathophyllum*.—414.
(?)*Cyathophyllum*, cf. *truncatum*, Linn. sp.—410 (retained for comparison).

Favosites gothlandica, Lam. Large massive examples; frequently silicified and strikingly weathered.—407, 448, 449. (No. 448 retained).

Favosites cf. *basaltica*, Goldfuss, var. *moonbienSis*, Eth. fil. (See Appendix).—405 (retained).

Monticuliporoid, indet.—420.

Cladopora sp. Casts in limonite of a strong ramose form.—426, 429, 433, 436, 445.

Corals indet.—438-440.

Stromatoporoid, indet.—421, 436.

A stromatoporoid, probably a species of *Clathrodictyon*. Weathered silicified specimen.—442. Retained for description.

Weathered outer surface of coral, probably *Tryplasma*.—394, 447. Retained for comparison.

(?)*Orthis*.—396.

Brachiopod remains, indet.—395, 398-400.

(?)Bivalved shell, indet.—401.

Euomphalus sp.—433.

Gasteropod, indet.—413.

(?)*Orthoceras*.—443, 444.

Ceratiocaris; appendages.—418, 419.

Fossils, indet.—393, 397, 402-404, 417, 422, 424, 425, 427, 428, 432, 434, 435, 437, 441, 450, 451.

W. of Thomson River (base of *Monograptus dubius* beds).—Nos. 408, 409. Coll. by Mr. A. A. Henderson.

Haliserites Dechenianus, Göppert sp.—408 (figd.), 409.

Fossiliferous Ochreous Mudstone. Cooper's Creek. Coll. by Mr. A. A. Henderson.—Nos. 452-493.

Coral; a simple rugose form, indet.—452, 483, 485.

Pleurodictyum megastomum, Dun. One corallum measuring about 6 cm. in diameter.—462, 468-471.

Monticuliporoids, indet. Casts.—455, 461.

Corals, indet—459, 460, 462, 484.

Crinoid stems.—453, 454, 458, 460-462, 493.

Crinoid stem (mould), having a diameter of 13 mm., with cast of axial canal 5 mm. across.—456.

(?)*Fenestella*.—452.

Leptæna rhomboidalis, Wilck. sp.—480.

(?)*Plectambonites*.—488

(?)Rhynchonellid sp. indet.—457.

Athyris cf. *concentrica*, v. Buch. sp.—473, 474.

Rhynchonellid, indet.—475, 476.

Brachiopods, indet.—459, 479, 481, 490, 491.

(?)*Palæoneilo*.—491.

(?)*Orthoceras*.—466, 467.

Fossils, indet.—472, 477, 478, 482, 486, 487, 489, 492.

No fossil remains.—463-465.

Nos. 468, 473, 474-476, retained for comparison.

"Western Conglomerate." Thomson River. (Probably a fine ash bed.) Coll. by Mr. A. A. Henderson.—Nos. 494-529.

Rugose coral, indet.—519.

Heliolites sp.—510, 512, 516-518, 520.

Monticuliporoids, indet.—498-501, 506, 509, 511, 513-523, 525, 527, 529.

Corals, indet.—496, 497, 507 (encrusting form), 508, 527.
Crinoid remains.—495, 497-500, 502-506, 509, 512-517, 519, 521, 522, 524, 525.
Fenestella sp.—516.
Leptæna rhomboidalis.—521.
Brachiopod remains, indet.—509, 529.
(?)*Euomphalus*.—527.

Grey Slate with Plant-remains. Vale's Adit. Coll. by Mr. A. A. Henderson.—Nos. 530-532.
Bythotrephis divaricata, Kidston.—531, 532 (figd. spec.). (See Appendix.)
Confervites acicularis, Göppert.—530. (See Appendix.).

Centennial Mine. Coll. by Mr. J. P. L. Kenny.—Nos. 533-560.
Haliserites Dechenianus, Göppert sp.—533-540, 542, 543, 545, 546, 548, 550-552, 554, 537, 558 (figd).
Plant remains (?), indet.—541, 555, 556, 559, 560.
Fossil remains, indet.—544, 553.
No recognisable fossil.—547.
(?)Worm or crustacean track.—549.

Middle Crossing, Deep Creek, Q.S. 22 S.W. Fossiliferous Limestone.—Nos. 561-592. Coll. by Mr. W. Baragwanath.
Favosites sp. (retained for description).—587, 589.
Stromatopora, *Favosites* and crinoid remains.—592 (retained).
Stromatoporoids (retained for description).—562, 571.
Corals (retained for description).—562, 564, 568, 571, 572, 573, 575, 576, 578, 584, 585, 588.
Corals, indet.—566, 567, 569, 570, 579, 583.
Crinoid remains, indet.—561, 563, 565, 569, 570, 574, 575.
(?)*Fenestella*.—576, 581, 582.
Fossil, indet.—580.
Crinoids and corals, indet.—586, 590, 591.

Fossiliferous Limestone. Cooper's Creek (Copper Mine).—Nos. 746-749. Coll. by Mr. W. Baragwanath.
Favosites sp. and *Heliolites* (retained).—746, 747, 749.
Favosites and stromatoporoid.—748.

Fossiliferous Chert. Road near Cooper's Creek Copper Mine.—Nos. 750, 751. Coll. by Mr. W. Baragwanath.
Remains of Brachiopods, Crinoids and Corals, indet.

Stander's Creek. Q.S., 34 S.W. A fossiliferous ash bed. Coll. by Mr. O. A. L. Whitelaw.
Favosites and crinoid remains.—752.
Of Silurian (Yeringian) age.

Fossiliferous Grit. Wood's Point Survey.—Nos. 858-868. Coll. by Mr. O. A. L. Whitelaw.

(?)Plant remains.—865.
Favosites sp.—858-861, 865.
(?)*Favosites*.—864.
A rugose coral, (?)*Lindstræmia*.—861, 866, 867.
Monticuliporoids.—860-863, 865, 867.
Crinoid remains.—868.
Brachiopods, indet.—859, 861, 863, 868.
Orthoceras sp.—859.
Silurian (Yeringian).

Fossiliferous (?)Ash-bed or Felspathic Sandstone. Morning Star Creek and Goulburn River.—Nos. 869-883. Coll. by Mr. O. A. L. Whitelaw.

Crinoid remains.—871, 873, 875A, 883.
Brachiopod remains, indet.—869-872, 874, 875, 875A, 876, 876A, 877-883.
(?)*Camarotœchia*.—878.

Fossiliferous Shale. Stacpooles' House, Wood's Point.—Nos. 884-889. Coll. by Mr. O. A. L. Whitelaw.

This rock is literally crowded with casts of the chambers of an indeterminate species of *Orthoceras*, with occasional impressions of the same fossil. cf. *Orthoceras* (*Protobactrites*) *baculiforme*, Salter, or *O. lineare*, Münster sp.

Nos. 884, 889, retained for description.

Fossiliferous Slate. Perkin's Creek and Goulburn River, Wood's Point.—Nos. 890-894. Coll. by Mr. O. A. L. Whitelaw.

Impression of an (?)*Orthoceras*.—890, 891.
(?)*Haliserites*.—892-4.

Felspathic Sandstone. Goulburn River, Wood's Point.—Nos. 895-898. Coll. by Mr. O. A. L. Whitelaw.

Haliserites sp.—895, 896.
Monticuliporoids.—897, 898.
Silurian. Probably high in the series.

Shaly Beds. Goulburn River, Wood's Point.—Nos. 899, 900. Coll. by Mr. O. A. L. Whitelaw.

Haliserites Dechenianus, Göppert.
Silurian. High in the series.

Fine Felspathic Sandstone. Matlock Road, near Big Comet Shaft, Wood's Point.—Nos. 901-903. Coll. by Mr. O. A. L. Whitelaw.

Haliserites Dechenianus, Göppert.
Silurian. High in the series.

Fossiliferous Grit. Gooley's Creek, above Shamrock Mine, Wood's Point.—Nos. 904-922. Coll. by Mr. O. A. L. Whitelaw.

Crinoid stems and plates; also brachiopod remains, indet.

Fossiliferous Grit. Goulburn River, Wood's Point.—Nos. 923-948. Coll. by Mr. O. A. L. Whitelaw.

Chiefly indeterminate crinoid remains; also monticuliporoids and brachiopods.

A small noduliform *Favosites*, cf. *F. forbesi*, Ed. and Haime.—928, 934. Retained for description.

Silurian (Yeringian).

Gooley's Creek, near Little Comet Mine, Wood's Point.—Nos. 949, 950. Coll. by Mr. O. A. L. Whitelaw.

(?)*Orthoceras*, indet.—949.

Obscure fossil remains.—950.

Fossiliferous Grit. Back of Mullani's House, Goulburn River, Wood's Point.—Nos. 951-981. Coll. by Mr. O. A. L. Whitelaw.

Crinoid remains and small corals or polyzoa.

A nodulose monticuliporoid.—966.

(?)*Diamesopora*.—951 (retained).

(?)*Camarotæchia* and coral, indet.—956.

Fossiliferous Slate, 1½ miles S.W. of Kelly's Hill, Yarra Track.—Nos. 982-984. Coll. by Mr. O. A. L. Whitelaw.

Pleurotomaria sp.—982. A similar, if not identical species is found in the beds of the Upper Yarra District.

Cycloceras tenuiannulatum, McCoy, var. *australis*, nov.—983, 984. (Type and figd. spec.)

Silurian (Yeringian).

Fossiliferous Conglomerate. 1 mile W. of Donnelly's Creek P.O.—Nos. 985-987. Coll. by Mr. W. Baragwanath.

Brachiopod remains, mostly indeterminate.

Cœlospira sp.—986 (retained).

Silurian; from a high horizon.

Fossiliferous Sandstone. Tallangalook, Block 115A.—Nos. 988-992. Coll. by Mr. A. M. Howitt.

Chiefly crinoidal remains.

Also *Favosites* (a small species).—990.

Casts of corals and monticuliporoids.—992.

Probably Silurian.

Fossiliferous Grit. Near Allot. 93A, Doolam, near Maindample.—No. 993. Coll. by Mr. A. M. Howitt.

Remains of crinoids and brachiopods, indet.

Probably Silurian.

Fossiliferous Mudstone. Allot. 106B, Doolam, near Maindample.—Nos. 994-1000. Coll. by Mr. A. M. Howitt.

Monticuliporoids, indet.—995, 997, 998, 1000.

(?)*Lindstræmia*.—999.

Crinoid remains, indet.—994-996.

Brachiopod remains, indet.—998.

Silurian.

Chert. Thomson River, Gippsland.—No. 595. Coll. by Mr. E. J. Dunn.

Originally a trilobitic limestone, containing also the remains of ostracoda and crinoids.

Appendix.—Notes on Fossils.

Series (?)*Thallophyta*.

Genus *Bythotrephis*, J. Hall, 1847.

Bythotrephis divaricata, Kidston. Pl. XXXVIII., Fig. 1.

B. divaricata, Kidston, 1886, Cat. Pal. Plants, Brit. Mus. (Nat. Hist.), p. 243. cf. Yates, 1829, Trans. Geol. Soc. Lond., 2nd Ser. vol. II., Pl. XXVII., Fig. 2.

The above species appears to be related to J. Hall's *B. gracilis*, as remarked by Kidston; but it may be distinguished from that form by the slender habit of its long lateral branches, which extend in the present instance to a length of 78 mm. In our specimen the side branches are, to some degree, flexuous, as in *B. tenuis*, J. Hall, but the main stem is more erect. The examples of *B. divaricata* in the British Museum collection are recorded from the Wenlock of Malvern in Shropshire, England.

Occurrence.—Centennial Mine, Vale's Adit, Walhalla (No. 532).

Genus *Confervites*, Brongniart, 1828.

Confervites acicularis, Göppert. Pl. XXXVIII., Fig. 2.

C. acicularis, Göppert, 1852, Flora der Ubergangsformation, p. 80, Pl. XLI., Fig. 3. Sandberger, 1856, Verst. Schicht. Nassau, p. 422, Pl. XXXVIII., Fig. 3.

The present specimen has numerous, long, slender branches of about 40 mm. in length. There are signs of secondary branches at intervals, at an acute angle of divergence. The numerous branches are all confluent close to the base, which is slightly swollen. Our fossil appears to be identical with Göppert's species, which only differs in having finer branches with a decided outward curvature. In Sandberger's description it is stated that there are no visible branches, but this is not borne out by the figure there given. It occurs in the Lower Devonian in Germany.

Occurrence.—Centennial Mine, Vale's Adit, Walhalla (No. 530).

Class (?)*Lycopodiales*.

Genus *Haliserites*, Sternberg, 1833.

(*Psilophyton*, Dawson, 1859).

Haliserites Dechenianus, Göppert. Pl. XXXVII., Figs. 1-7.

H. Dechenianus, Göppert, 1847, Neues Jahrb. für Min., p. 686. Id., 1852, Foss. Flora d. Ubergangs, p. 88, Pl. II.

Psilophyton robustius, Dawson, 1859, Quart. Journ. Geol. Soc., vol. XV., p. 481, Figs, 2*a*, *b*. Id., 1871, Foss. Plants, Devon. and Upper Silur. Form. of Canada, p. 39, Pl. X., Fig. 121; Pl. XI., Figs. 131-132; Pl. XII.

P. Dechenianum, Göppert sp., Carruthers, 1873, Journ. Botany, vol. II., p. 326, Pl. 137, Figs. 1 (?2), 3, 4.

P. Dechenianus, Göppert sp., Kidston, 1886, Cat. Pal. Plants, Brit. Mus., p. 232.

Haliserites Dechenianus, Göppert, Penhallow, 1893, Proc. U.S. Nat. Museum, vol. XVI., p. 112.

H. Dechenianus, Göppert, F. Chapman, 1908, Geol. Mag., Dec. V. vol. V., p. 438, Pl. XXII.

In his notes on Erian Plants, Professor Penhallow regards *Haliserites* and *Psilophyton* as of distinct generic position; the former having a membranaceous frond, the latter a scaly stem. Mr. Carruthers' paper on this subject gives sufficient proof that they are one and the same plant; but no reference to this paper is made by Prof. Penhallow.

The Victorian specimens are represented chiefly by long, straight, or slightly curved stems or stalks with a midrib; or by shorter curved fragments, often with a longitudinally lineate surface. There are also occasional, well-preserved examples, which show sporangia attached to the stems or branchlets, and also circinate terminations to the latter.

The genus is better known from the Devonian formation of Canada (Dawson, Penhallow), and Scotland (Miller, Jack, Etheridge, jun., Peach, Salter, Carruthers), but has also been recorded (as *Psilophyton robustius*) from the Silurian of Canada by Dr. W. Dawson.

Occurrence.—Examples of the above genus, many referable without doubt to Göppert's species, are here recorded from the Centennial Mine, Walhalla; Perkin's Creek and Goulburn River, Wood's Point; Matlock Road, near Big Comet Shaft, Wood's Point; Halford's House Hill, Kongwak, near Jumbunna; and Thomson River (*Monograptus dubius* beds).

Class *Anthozoa.*

Genus *Favosites*, Lanark.

Favosites cf. *basaltica*, Goldfuss, var. *moonbiensis*, Etheridge fil.

Records Geol. Surv. N. S. Wales, vol. VI., pt. III., 1899, p. 164, Pl. XXIV., Figs. 1, 2; Pl. XXIX., Fig. 2.

Should the occurrence of this variety in beds of undoubted Yeringian age be confirmed, it will denote an older range than was supposed, although Mr. Etheridge concluded that the Moonbi Limestone of New South Wales was older than the Moore Creek and Woolomol Limestones. Specimen No. 405 is a replacement in limonite. The corallum is massive, and apparently of depressed tabular form. The walls of the corallites are shown as a honeycomb replacement, and large mural pores are seen, arranged in a uniserial manner. The corallites measure about 1 mm. in diameter.

Occurrence.—Thomson River (Aberfeldy Divide).

Class *Cephalopoda.*

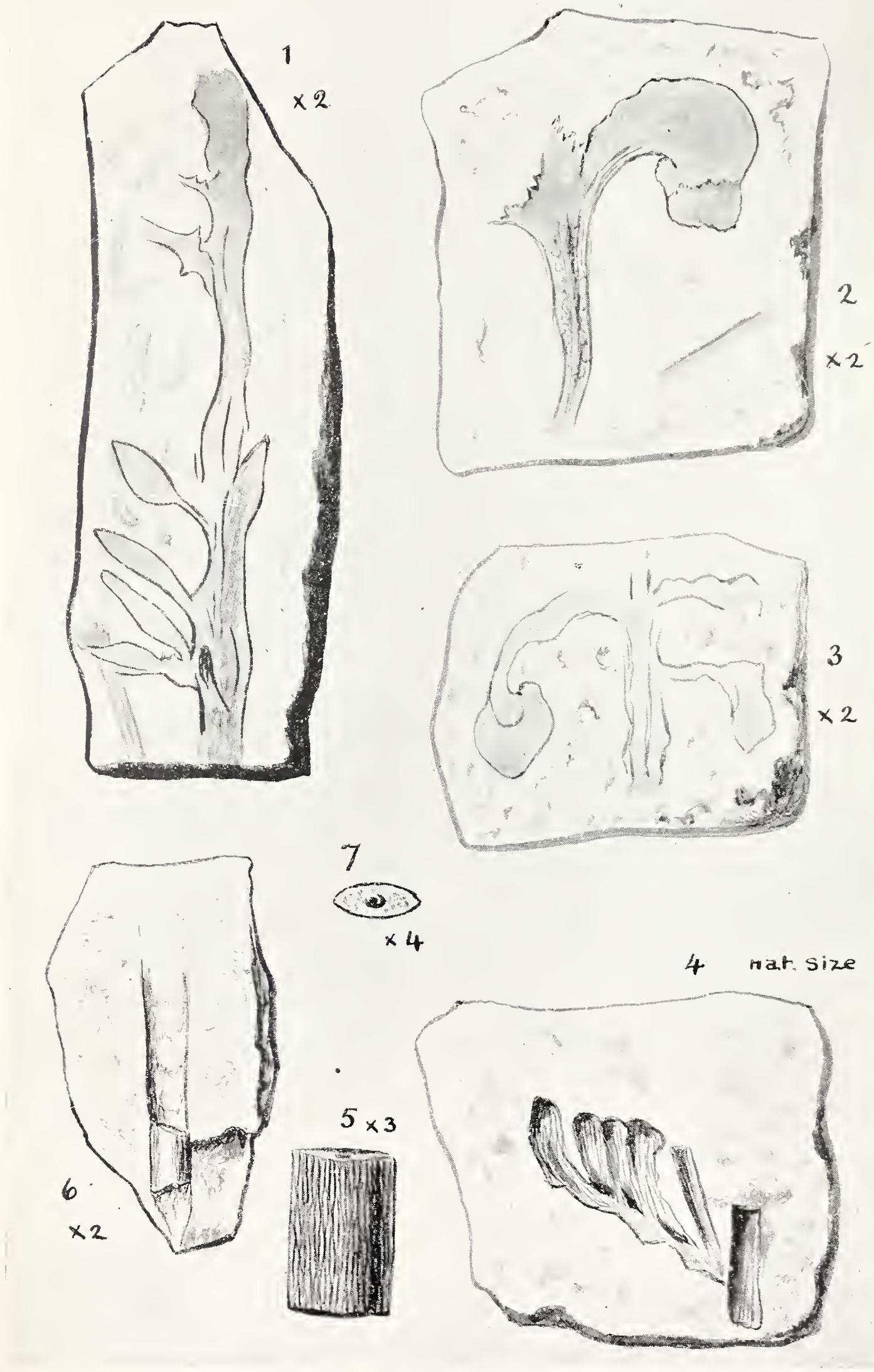
Genus *Cycloceras*, McCoy.

Cycloceras tenuiannulatum, McCoy sp., var. *australis*, nov. Pl. XXXVIII., Figs. 3, 4.

Ref. to type species.—McCoy, 1852, Brit. Pal. Foss., p. 320, Pl. IL., Fig. 31.

The Victorian variety differs from the species described by McCoy in the greater number of rings to a given length, and in the discontinuous vertical striation, which in our specimen is emphasized on the annuli, imparting to the rings a subnodulose character. The number of rings at

Plate XXXVII.



F.C. ad nat. del.

HALISERITES DECHENIANUS, GÖPPERT. SILURIAN: GIPPSLAND.

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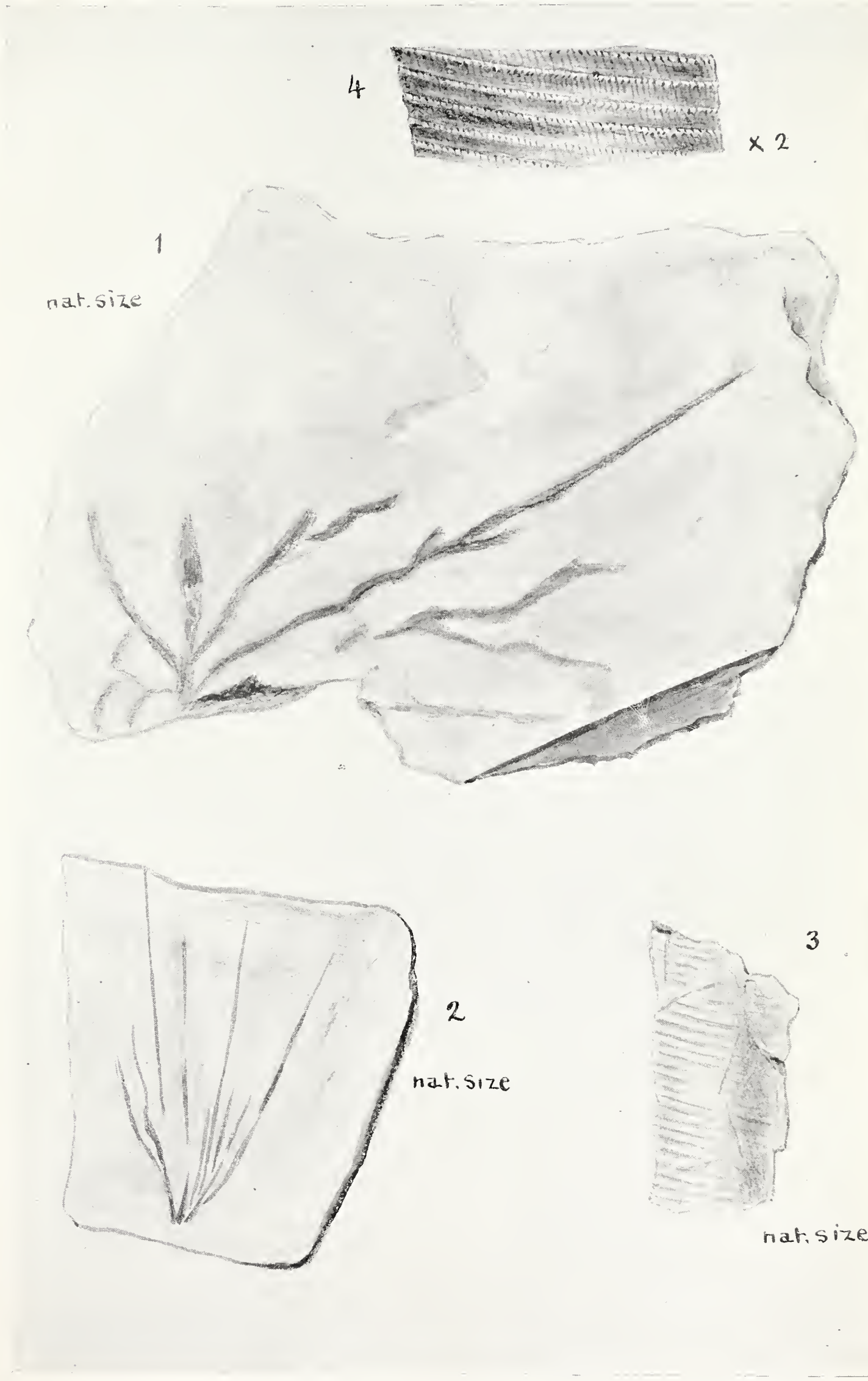
Plate XXXVIII.



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SILURIAN FOSSILS : GIPPSLAND.

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a part of the shell where the diameter (allowing for crushing) is about 15 mm., is 6 in the length of 8 mm. The characters of the external surface of the shell in our specimen were derived from a wax squeeze of an external mould in slate.

The British species has been recorded from the Lower Ludlows, the Aymestry Limestone, and the Upper Ludlows, of Shropshire, Herefordshire, and Westmoreland, respectively.

Occurrence.—One and a-half miles south-west of Kelly's Hill, Yarra Track, Wood's Point.

Class *Arthropoda.*

Genus *Ceratiocaris*, McCoy.

Ceratiocaris cf. salteriana, Jones and Woodward.

C. salteriana, Jones and Woodward, 1885, Third Rep. Pal. Phyllopoda, Brit. Assoc., p. 348. Id., Pal. Soc. Mon., Brit. Pal. Phyllopoda, pt. 1, vol. XLI., 1888 (for 1887), p. 55, Pl. VII., Figs. 1*a*, *b*, 2, 3.

Two fragments of a comparatively coarse-ribbed *Ceratiocaris*-carapace occur on specimen No. 380. The nature of the surface ornament, which also bears a faint oblique cross striation, points to a form like that of the above species, from the Lower Ludlows of Ludlow and Dudley.

Occurrence.—North Boundary, Thomson River (*Monograptus dubius* beds).

Explanation of Plates.

XXXVII.

Haliserites Dechenianus, Göppert.

Fig. 1.—Specimen showing ovate (?) leaves. Near N. Boundary, Thomson River. No. 390. × 2.

Fig. 2.—Portion of a circinate termination. Same locality. No. 391. × 2.

Fig. 3.—Part of a stem with (?) sporangiophore and leaves. Centennial Mine. No. 537. × 2.

Fig. 4.—Stem, and leaves in series. W. of Thomson River. No. 408. Nat. size.

Fig. 5.—Cast of the mould of a stem, showing the outer woody layer of cells, and conspicuous vascular axis. W. of Thomson River. No. 408. × 3.

Fig. 6.—Part of a stem. Centennial Mine. No. 558. × 2.

Fig. 7.—End view of a stem fragment showing vascular axis, and flattened character of the once cylindrical stem. Centennial Mine. No. 558. × 4.

XXXVIII.

Fig. 1.—*Bythotrephis divaricata*, Kidston. From the grey slate, Vale's Adit. No. 532. Nat. size.

Fig. 2.—*Confervites acicularis*, Göppert. Grey slate, Vale's Adit. No. 530. Nat. size.

Fig. 3.—*Cycloceras tenuiannulatum*. McCoy, var. *australis*, nov. S.W. of Kelly's Hill, Yarra Track, Wood's Point. No. 983. Nat. size.

Fig. 4.—Part of a wax squeeze taken from a mould of same specimen, showing surface ornament. No. 984. × 2.

[*Report sent in 14.5.08.*]

REPORT ON JURASSIC AND CARBONIFEROUS FISH-REMAINS.

By Frederick Chapman, A.L.S., &c., Palæontologist to the National Museum.

JURASSIC SANDSTONE WITH CERATODUS.—Parish of Kirrak, S. Gippsland. Plate XXXIX.

The specimens numbered 4,413 are two opposite halves of a bore-core [1] in fine-grained, greenish, carbonaceous sandstone. Each of the apposed surfaces bears a portion of the split outer lamina of a scale referable to the genus *Ceratodus*. Although the scale is large, it is not inconsistent with the idea that it may belong to the same species of fish, *Ceratodus avus*, to which the tooth from similar beds at Cape Paterson was referred by Dr. A. S. Woodward [2]. The allied living form, *Neoceratodus forsteri*, also has very large body scales, "often measuring more than 4 inches across" [3]. It is of some importance to note that the above fossil came from the same district as the tooth described by Dr. Woodward.

The discovery of this specimen is of great interest and scientific value, since, so far as I am aware, no scales of a fossil *Ceratodus* or *Neoceratodus* have hitherto been recorded; the various occurrences from the Bunter Series onwards, being based on the teeth, a skull, and a tail.

Description.—Scale of *Ceratodus* (?) *avus*, A. S. Woodward. Colour, a dark purplish-brown. Surface dull, with a slight sheen in places. Sub-rhomboidal; the embedded area somewhat rounded, the exposed portion obtusely pointed. The marginal border of the exposed part of the scale is occupied by a series of slightly undulating, parallel and depressed ridges, which feebly persist also in the basal area, and indicate lines of growth. Surface of basal area divided into rhombs or trapezes by a network of fissues in the outer layer of the scale. The shape of this scale indicates that it came from the ventral surface of the body, probably near the pectoral region. Although the squamation of *Ceratodus* is generally referred to as of the cycloid type, it was shown by Prof. Williamson and Dr. Günther that the scales of *Ceratodus* have a peculiarly interesting structure.[4] They consist of two strata, an inner and thicker, composed of numerous layers (Günther counted about 42) of fibrous cartilage—which has since disappeared in the fossil—and an outer layer, comparatively thin, of phosphatic and calcareous material, in which numerous calcareous granules are embedded in the attached portion of the scale, and which appear in places on the surface as blunt spines surrounded in some cases with a series of foramina.[4] In this, therefore, *Ceradotus* seems to show an annectant character, linking it with the ganoid or enamelled scale type, and in our fossil similar characters are to some extent present. Upon a close examination of the base of the scale in the present example there is seen distributed over the surface of the areolæ a granular deposit of a pale bluish tint, such as is found in the layers on a typical ganoid scale. The granulations occur towards the base of the scale, often arranged in fine lines in a fore and aft direction, but sometimes radiating, the granules thus imparting a micro-shagreen character to that part of the scale-surface.

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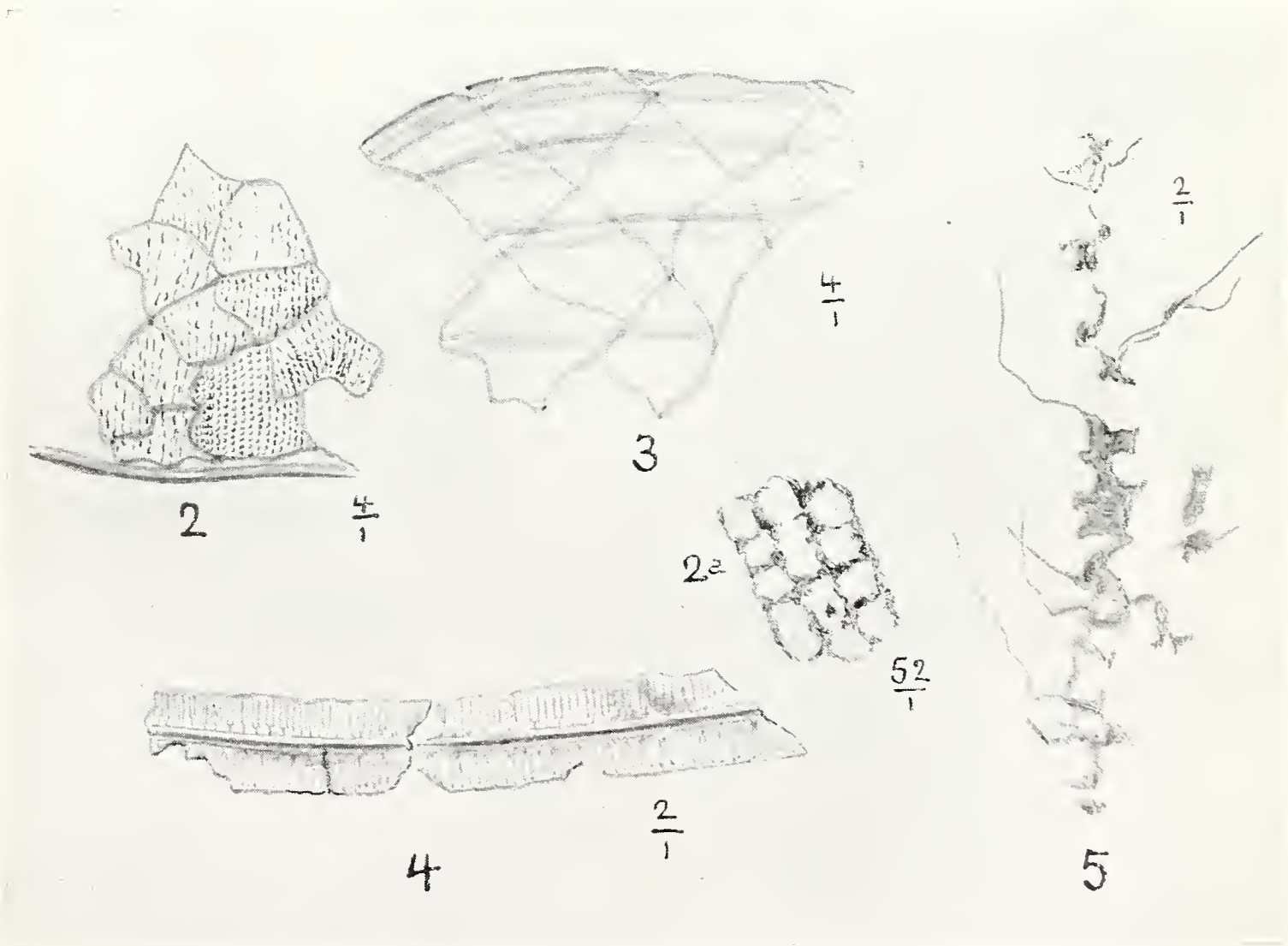
1. Other data on label as follows:—"No. of Drill, 9'; No. of Bore, 2; No. of Sample, 27; Depth, 26 feet. Date, 13th October, 1908."
2. Annals and Mag. Nat. Hist., ser. 7, vol. XVIII., 1906, pp. 1-3, pl. I. Reprinted in Records Geol. Survey Vict., vol. II., pt. 2, 1907, pp. 135-137.
3. Stead, D., "Fishes of Australia," 1906, p. 230.
4. Gunther, A. Phil. Trans. Roy. Soc., Vol. CLXI., 1872, p. 516, Pl. XXXI.

Plate XXXIX.

Fig. 1.
F.C., photo.



F.C. ad nat. del.

SCALE OF CERATODUS AND PLANT REMAINS.—JURASSIC: KIRRAK, S. GIPPSLAND.

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From the fact that these granulations appear on each of the specimens one is led to infer that only the outer layer is preserved. In one of the fossils the granules show the broad bases, indicative of the presence of spinous tubercles.

A comparison of the present specimen with scales of the living *Neoceratodus forsteri* shows our Jurassic example to have certain distinct characters of its own, both as to its superficial structure and the general shape of the scale. There is, however, a striking general resemblance to that of the scale of the living form, greater than one would expect from a specimen differing so widely in age.

Dimensions—

Length from base to point, 59 mm.
Extreme width at its exposed base, 58.25 mm.
Width of border marked by parallel series of ridges, about 13 mm.

Remarks.—The matrix in which this scale was embedded affords some interesting data as to the conditions of existence of *Ceratodus* in Jurassic times. The sandstone is finely laminated, and was probably laid down in large freshwater lakes or partially land-locked estuaries. The associated vegetable remains on the same slab are of importance as showing the contemporaneity of the rhizomatous plant *Tæniopteris spatulata*, var. *Daintreei*, whose leaves are abundantly distributed through the rock; whilst there is also present a coniferous branch, probably referable to *Palissya australis*, McCoy. In the case of the recent fish we find its habit is to feed greedily upon the leaves of water plants which are in a decomposing state; and it does not require one to trespass far into the field of imagination to suppose that drifted masses of *Taniopteris* may have furnished the Jurassic *Ceratodus* with its principal pabulum, intermixed with small aquatic animals associated with the vegetable *débris*. A comparison of Queensland specimens of *Neoceratodus* scales in the National Museum collection shows the dimensions of this scale to indicate a fish of about 1 metre in length.

Carboniferous Sandstone with Fish-Remains, Parish of Barwite, Allot. 298. Collected by Mr. A. M. Howitt. Nos. 1941-2022.

These specimens are characteristic of the Mansfield Carboniferous fish-fauna, and in some instances their structure is particularly well preserved. This is especially the case with the teeth and scales of *Strepsodus decipiens*, A. S. Woodward.

Gyracanthides murrayi, A. S. W.

Pelvic fin-spines.—Nos. 1941, 1945, 1946, 1949, 1952, 1963, 1972, 1975, 1977, 1978, 1985, 1989, 1991, 1996, 1998, 2000, 2003, 2004, 2009, 2020-2022.

Pectoral fin-spines.—Nos. (?) 1954, (?) 1970, (?) 1971, 1990.

Anterior free pectoral spines.—Nos. 1958, 2017, 2020.

Posterior free pectoral spines.—Nos. 1947, 1962, 1966, 1968, (?) 1992, 1994, 1997, 2001.

Plate connected with free pectoral spine.—No. 1964.

Fragmentary remains.—Nos. 1965, 1969, (?) 1984

Strepsodus decipiens, A. S. W.

Teeth.—Nos. 1942, 1955 (the slab on which this occurs is part of a ripple-marked layer of sandstone), 1957, 1959, 1960, 1980, 2010, 2016.

Scales.—Nos. 1942, 1944, 1948, 1950, 1951, 1953, 1963, 1966, 1967. 1973, 1976, 1979, 1980, 1982, (?) 1983, 1986, 1992, 1993, 1995, 1999, 2002, 2013-2015, 2018.

Portion of (?) jugular plate.—No. 1942, 1967.
Fragments.—No. 2011.
Fish remains, indet.—1943, 1956, 1961, 1974, 1981, 1987, 1988, 2005-2008, 2012.

Explanation of Plate.

XXXIX.

Fig. 1.—Scale of *Ceratodus* (?) *avus*, A. S. Woodward. About nat. size.

Fig. 2.—Portion of basal area of scale of *Ceratodus* (?) *avus*, showing arrangement of minute granules of enamel. × 4.

Fig. 2A.—A group of the smaller tubercules highly magnified. × 52.

Fig. 3.—Part of border of distal half of scale of *Ceratodus* (?)*avus*, showing depressed ridges and division of area by fissures. × 4.

Fig. 4.—Fragmentary lamina of *Tæniopteris spatulata*, var. *Daintreei*, McCoy, found on same slab with the *Ceratodus* scale. × 2.

Fig. 5.—A fragmentary branch of *Palissya australis*, McCoy, in which the leaves are turned edgewise to the plane of the slab, and the stem, with petiole bases are imperfectly preserved. Found associated with scale of *Ceratodus*. × 2.

[*Report sent in 5.12.08.*]

ON THE OCCURRENCE OF SCALDICETUS IN VICTORIA.

By Fredk. Chapman, A.L.S., &c., Palæontologist to the National Museum, Melbourne.

Note on the Genus.—The genus *Scaldicetus* was established in 1867 by Du Bus[1], for a type of cetacean tooth of the family of the Sperm Whales (*Physeteridae*). The diagnosis of the genus is thus given in the British Museum Catalogue by R. Lydekker[2], quoting from Du Bus' original description. "The teeth are somewhat smaller than those of *Physeter macrocephalus*, and are distinguished by a coat of grooved enamel on the summit of the crown. The section of the tooth is subcircular; the cement is abundant and much thicker in the middle than at the two extremities, thus causing the tooth to be fusiform; the dentine core is subcylindrical throughout the greater part of the tooth; and the central axis of dentine very slender, darker in colour than the overlying layer, and without a nodular structure. In the young specimens the pulp cavity is open and conical in shape."

Du Bus' type specimen was named *Scaldicetus carreti;* it was found in the Antwerp Crag (Lower Pliocene), at Borgerhout, Belgium, and is preserved in the Museum at Brussels. There is a cast of one of the teeth in the British Museum (Nat. Hist.), M. 3658. The original specimen consists of a series of 45 associated teeth, evidently belonging, says Du Bus, to the same individual. Their lengths vary from 20-24 cms., and their largest circumference between 40 and 53 cms. They are elongated cones, a little narrower towards the base, gently curved, principally towards the crown, of which the enamel is longitudinally striated. They are excavated at their base for two-thirds or three-quarters of their length. The weight of the largest is a kilogramme and a half[3].

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[1] Bull. Ac. R. Belg., scr. 2, vol. XXIV., p. 568.
[2] Cat. Foss. Mammalia in the Brit. Mus. (Nat. Hist.), pt. V., 1887, p. 57.
[3] Op. supra cit., p. 567.

Plate XL.

Fig. 1.

Fig. 2.

Fig. 3.

F.C., photo.

TOOTH OF SCALDICETUS, FROM THE KALIMNAN OF BEAUMARIS, PORT PHILLIP BAY, VICTORIA.

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Occurrence and General Remarks.—A few years ago Mr. F. D. MacGee obtained the present very interesting specimen of a cetacean tooth from the ferruginous and calcareous clays of the Beaumaris Cliffs, a quarter of a mile north of the Beaumaris Hotel, and at about 6-10 feet above high water mark. This tooth, therefore, came from the midst of the Kalimnan series, and not from the basal bed with rolled fossils.

The shape and size of this tooth is essentially different from that of *Physetodon baileyi*, McCoy [1], teeth of which occur also in the Beaumaris Cliffs. It is notably much shorter in proportion than that species, widening rapidly towards the base; the conical pulp-cavity, as in the living *Physeter*, is hollow. In *Scaldicetus* the apex is covered by an enamel cap, which is grooved longitudinally. This enamel cap is well preserved in our specimen, except for the extreme point, which has been broken off. The larger portion of the external surface of the tooth is covered by the cement. This is in the form of a thin layer, almost uniform, and not much thicker in the middle portion of the tooth, the contrary being the case in the Belgian genotype; for even quite superficial fractures reveal the underlying dark-brown core of dentine.

Through the kindness of Drs. A. Smith Woodward, F.R.S., and C. W. Andrews, F.R.S., my conclusion as to the generic position of the Victorian fossil has been confirmed, these gentlemen having compared a photograph of the present specimen with the British Museum example of *Scaldicetus*.

Although we have no knowledge of the cranial parts of the animal, nor a complete series of teeth, yet I think we may justifiably assign a new specific name to the present tooth, on account of its marked difference in shape from the Belgium specimens, which are not only half as long again, but proportionately much wider at the base.

Description of Scaldicetus macgeei, sp. nov. Plate XL.

Tooth.—Present length, 118 mm.; lost height of apex, cir., 7 mm.; greatest width of tooth, at opening of pulp-cavity, 48 mm.; narrower diameter of same, 43 mm.; extent of root (below enamel cap), 83 mm.; probable height of enamel cap, cir. 42 mm.

Shape, a stout cone, with a moderate curvature, apical portion more strongly curved. Pulp cavity large and deep. Surface of enamel cap rugosely, vertically striated, otherwise smooth and shining. Thickness of the enamel, revealed at the fractured apex, 1.25 mm. Base of enamel cap projecting over surface of dentine cone. The latter dull, and with a bony texture, but where fractured beneath the surface, dark brown, shining with a resinous lustre. Encircling, wavy bands extend around the basal part of the dentine cone. A transverse section through the enamel cap would give a subcircular or broadly elliptical figure; that through the pulp-cavity, an irregularly subcircular outline, depressed on the concave side of the tooth.

The holotype is named in honour of its discoverer, who has deposited it on loan in the National Museum.

Stratigraphical Remarks.—The Beaumaris Cliffs consist of ferruginous and calcareous clays, and contain a fauna which is referred to the Kalimnan series of Victoria. This series also embraces other fossiliferous beds in the same State, at Jemmy's Point, Gippsland Lakes; near Hamilton

1 Prod. Pal. Vict. Dec. VI. 1879, p. 19, Pl. LV., Figs. 1, 2.

at Grange Burn ("Forsyth's"), and Muddy Creek ("McDonald's"); also on the Glenelg River; and in the upper part of the borings in the Wimmera. In S. Australia, in the upper beds at Aldinga; and in various borings in that State.

The homotaxial equivalents of our Tertiary strata can only be decided upon by a comparison of universally distributed organisms; and the group of the Cetacea will, no doubt, furnish us with some valuable data in this respect. On these grounds the present occurrence of so restricted a form in European Tertiary deposits is of the greatest value and interest. It also tends to confirm Prof. Sir F. McCoy's conclusion as to the age of the Beaumaris beds, as given in his statement with regard to the discovery of *Physetodon baileyi*, made in 1879[1], when he referred to "the ferruginous layers of the older Pliocene Tertiary strata of Mordialloc" (— Beaumaris.)

Explanation of Plate.

XL.

Fig. 1.—Tooth of *Scaldicetus macgeei*, sp. nov.; showing large, open pulp-cavity. Nearly $\frac{3}{4}$ natural size.

Fig. 2. Ditto; showing enamel cap, and cement layer of the basal portion revealing the dentine layer beneath. Nearly $\frac{3}{4}$ natural size.

Fig. 3. Ditto; showing the rugosely striated enamel cap, slightly enlarged. $1\frac{7}{20}$th natural size.

[*Report sent in 14.1.10.*]

1 Prod. Pal. Vict., Dec. VI., 1879, p, 20.

PRESENTED.
20 AUG. 1912

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By Authority: J. Kemp, Government Printer, Melbourne.

REFERENCE.

1. Casterton
2. Coleraine
3. Hall's Gap
4. Mt. William
5. St. Arnaud
6. Wehla
7. Goldsborough
8. Dunolly
9. Waanyarra
10. Landsborough
11. Homebush
12. Maryborough
13. Amherst
14. Clunes
15. Moolort
16. Bendigo
17. Castlemaine
18. Chewton
19. Fryerstown
20. Taradale
21. Drummond
22. Redesdale
23. Daylesford
24. Eganstown
25. Rocky Lead
26. Croswick
27. Marong
28. Sebastian
29. Bromley
30. Barp
31. Bet Bet
32. Painswick
33. Tarnagulla
34. Llanelly
35. Inglewood
36. Wedderburne
37. Bullarook
38. Wombat
39. Dean
40. Korweinguboora
41. Smeaton
42. Ballarat
43. Elaine
44. Woodend
45. Mansfield
46. Kevington
47. Myrtleford
48. Nowa Nowa
49. Mt. Wellington
50. Accommodation Ck.
51. Wareek
52. Darook
53. Hepburn
54. Jericho
55. Rushworth
56. Mitta Mitta
57. Glen Wills
58. Buchan
59. Clonbinane
60. Bemm River
61. Merrijig
62. Limestone Ck.
63. Kongwak
64. Seville
65. Kerrie
66. Walhalla
67. Aberfeldy
68. Wood's Point
69. Donnelly's Ck.
70. Tallangalook
71. Doolam
72. Kirrak
73. Barwite

NEW SOUTH WALES

KILFERRA
WALJEERS
TAILA
CARA
STURT
COOPER
BLAND
WARADGERY
MILLEWA
BOYD
BOURKE
CLARENDON
KARKAROOC
WAROOL
TOWNSEND
BARNA
MITCHELL
WYNYARD
WEEAH
TATCHERA
DENISON
HUME
GULBURN
CADELL
GUNBOWER
SELWYN
KARA KARA
GLADSTONE
BENDIGO
RODNEY
WALLACE
BOGONG
BENAMBRA
LOWAN
DELATITE
WELLESLEY
AUCKLAND
TORRUNG
TARRAWINGEE
WONNANGATTA
TAMBO
DUNDAS
RIPON
BOURKE
EVELYN
DARGO
ROSLINGOLONG
TOLLET
TANJIL
GRANVILLE
GRANT
NORMANBY
HAMPDEN
PORT PHILLIP BAY
MORNINGTON
HEYTESBURY
POLWORTH
BULN-BULN

Dense Scrubs of Eucalyptus Dumosa

Sandy Desert with Mallee

Scale, 16 Miles to 1 Inch

GEOLOGICAL SURVEY RECORDS
LOCALITY PLAN
VICTORIA

Fossil localities +
Other localities ⊙

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